A Post-Industrial Landscape:
The use of bioremediation in the creation of urban park space

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May 2011

Undergraduate Landscape Architecture Comprehensive Project
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Abstract

The reuse of derelict sites for new purposes is becoming more and more important as time goes on. All across the country (and the globe) designers are now presented with the responsibility to transform the urban landscape and re-envision the way in which we view dilapidated areas. This project identifies the environmental concerns of remediating a brownfield, the various benefits of converting an industrial brownfield into a park space, and the most effective remediation strategies to clean up such properties. More specifically, this project explores the site of a former manufacturing gas plant (MGP) on the southeast side of Indianapolis and displays how it can and should be transformed into a large regional park to serve the residents of a struggling community.

The MGP, currently owned by Citizens Energy, has been located on this exact property for over a century and thus, poses inherent environmental challenges such as soil, water, and air pollution. To remove extremely harmful contaminants and restore the soil and groundwater, the redesign of the site integrates various bioremediation methods. Despite the intense remediation process, the integration of various park amenities and effective pedestrian access, and the realignment of the adjacent greenway are important design components.

The site of the former Indianapolis Coke facility will inspire revitalization of the surrounding community, provide underserved recreational opportunities, remove the stigma associated with the site, emphasize the history of the facility and the southeast side, and will be restored to reflect the natural environment that once existed there.

Acknowledgements

As this project marks the end of my time at CAP, I would like to express how indebted I am to the people who have supported me throughout my college career and for those who have helped me stay sane.

To complete this project, I was lucky enough to receive some expert advice and information from Andre Denman & Ben Jackson, both senior planners at IndyParks and from John Pichtel, an expert in hazardous wastes and Professor of natural resources at Ball State University. The information they provided had great bearing on my project and I am very thankful for their kind help.

And finally, I am grateful for what I have learned throughout the duration of this project and am happy to be able to share it with others. It is my hope that everyone who picks up this document can learn something and be enriched by it even in the slightest.

Contents

Introduction

“What does the large metropolitan park constructed on a site degraded by the processes of human consumption and industrial production mean? The urban institution known as the public park, once associated with landscapes affording urban dwellers respite from the world of work, consumption, and production, is now made on the detritus and the uncertain, perhaps toxic, by-products of that realm.”

- Elizabeth K. Meyer

Modern urban environments are ripe with void, underused spaces. Today we reject our industrial past and turn a blind eye from these properties hoping that they will magically turn into useful spaces once again. But it is these urban voids that are our opportunities to transform and revitalize struggling urban environments. Often vacant and inactive, they can become our community centers, our neighborhoods, and our mixed-use districts. Above all, they can become our public parks.

While some brownfields are quickly capped and converted into new places of business, this kind of transformation does little to rid the site of contamination and a future of concealed complications. It is merely a mask. On the other hand, if brownfields are converted into park and open space, they then become opportunities for recreation, education, and true environmental revitalization. Park users are given the opportunity to learn about the natural environment and how it can be restored and are also able to enjoy the benefits of recreation to improve their social, physical, and mental health. Overall, major economic, social, and environmental benefits are reaped from this kind of redevelopment.

The site chosen to display these concepts was first introduced to me during my summer internship at Indy Parks and Recreation. Following the closure of the facility in 2007, Indy Parks was interested in purchasing the property for the development of a regional park. However, the lack of funding was a major obstacle that could not be surpassed. Despite this setback, continuing to create a new vision for this 140-acre property will prove to be incredibly valuable when a future opportunity for funding and development arises. It is time for communities to redefine how they treat derelict sites and re-envision their value as community open spaces.


Background

As populations rise and urban areas continue to expand outward, the reuse of vacant properties within the urban core is gradually becoming a more feasible and attractive option. The obstacle, however, is that prospective vacant properties are often derelict and contaminated industrial sites in need of often expensive improvements. The poor state of these sites necessitates a more sensitive treatment and redevelopment strategy in order to avoid dangerous environmental, social, and economic consequences. Interestingly, there is a growing body of research that supports the use of environmentally-responsible remediation techniques that point toward a new direction for the redevelopment of brownfields. The purpose of the following review of literature is to explore the benefits of brownfield redevelopment as park space and to identify the environmental concerns and clean-up strategies that may be employed on such brownfields.

Environmental concerns

The redevelopment of any industrial site results in fundamental concerns for the safety of both the users and the environment. This is caused by the poor state in which these properties exist as a result of past wasteful manufacturing strategies, the involvement of hazardous materials, and insensitive disposal techniques. It is important, however, that each brownfield is treated appropriately according to the harmful substances present at each site and the threats they pose to potential visitors and sensitive ecosystems. For example, the environmental state of an abandoned coke plant may differ somewhat from the state of an abandoned rail yard.

Coke Process

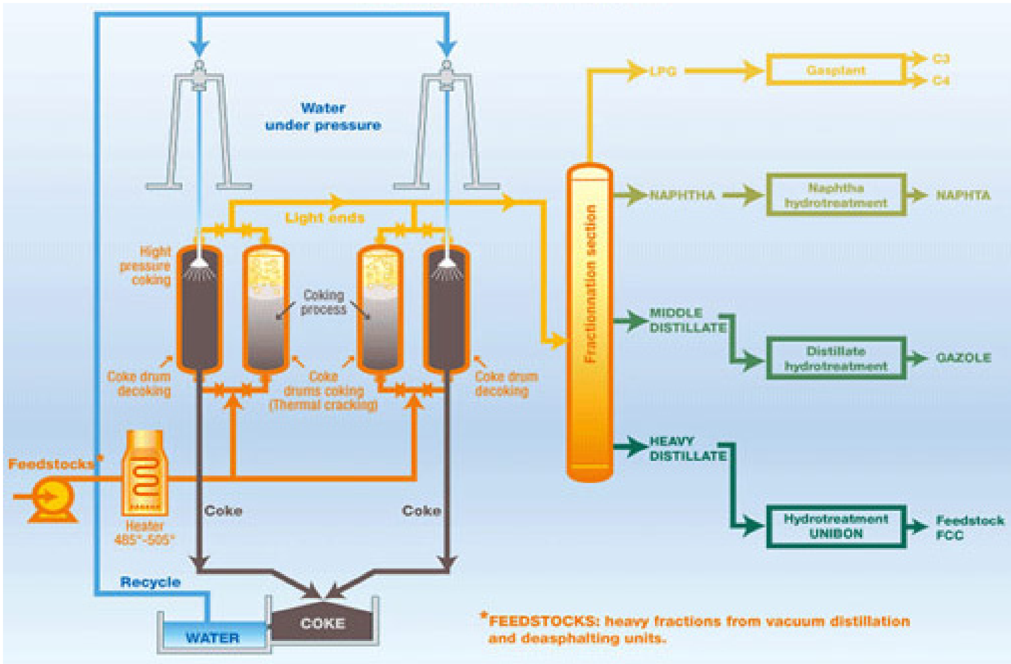
A coke plant is the site of the coking process, which involves the heating of raw coal to very high temperatures. This intense reaction is intended to produce pure coke but also produces various harmful by-products. The coke produced goes on to be used in metal foundries for metallurgical purposes and to be burned again to produce energy (as is the case with the particular coke plant in question).

Right: Figure 1 - Coking Process.

Liquid by-products, including tar, ammonia sulfate, ammonia liquor, and light oil, often return to the coke ovens to be burned again or may become environmental pollutants (Gorman 573). Gas is collected in the coke ovens during the coking process. Finally, the resulting coke is showered with water to remove impurities and decrease its temperature (Ghose). See Figure 1.

Water Quality

One major concern of redeveloping the land where this process once occurred is the resulting on-site water quality caused by the irresponsible leaching of damaging by-products like volatile hydrocarbons, lubricants, phenols, and heavy metals such as lead, mercury, and cadmium (Gorman 549). A large amount of water is used in the gas washing






process in the quenching tower, resulting in slightly contaminated water. However, the most damaging effluents in the coke plant are formed when condensation collects in the gas coolers because this condensation contains concentrated substances like ammonia, phenols, cyanide, and sulfides that are especially harmful to aquatic life. These pollutants prohibit organisms in water bodies from acquiring oxygen by forming an impermeable layer on the surface of the water. Furthermore, larger solid particles can clog the respiratory systems of aquatic organisms, worsening the local ecosystem (Ghose 254-255).

Air Quality

Poor air quality at coke plant sites is also a major environmental issue. In a study completed in Atlanta, Georgia, air samples were taken on and adjacent to an abandoned manufactured gas plant and tested for a variety of volatile organic compounds (VOCs) and PAHs (polycyclic aromatic hydrocarbons). Interestingly, the levels of these harmful substances were not found to be at damaging levels – even for Occupational Safety and Health Administration (OSHA) standards. However, during remediation of the site which involved excavation, treatment, and transport of contaminated soil, VOC and PAH levels increased dramatically. This phenomenon shows that the mere presence of these compounds in the environment is not harmful, but the movement and displacement during the remediation process is (Collins). It is evident that caution must be taken to avoid an increase in air pollutants caused by unnecessary disruption of the soil. For example, in extreme cases, covering the contaminants by capping may be necessary to prevent exposure to very dangerous chemicals in the air. However, with adequate funding, more conscientious strategies that actually remove the contaminants are favored in order to better the environment for future generations. There is a fine balance that must be struck between these two ideals. Interestingly, studies have shown that communities often have little or no concern for the possibility of exposure to contamination. One reason they feel this way is because the sites are safer than they would otherwise be (De Sousa, Brownfields Redevelopment 179-180).

Brownfields as parks

The conversion of brownfields into park spaces is a concept that is currently growing in popularity both in the United States and abroad. Projects such as Landschaftspark Duisburg-Nord by Peter Latz, an old metal works operation, and Fresh Kills Park by Land Operations, once a 2,000-acre landfill on Staten Island, come to mind. While the use of contaminated and derelict properties may pose inherent dangerous risks, there is also a plethora of reasons why brownfields should be considered good candidates for the location of urban park space.

Environmental benefits

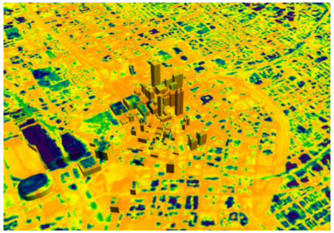
The location of park space on urban brownfields has several environmental benefits including the protection of groundwater and soil resources (De Sousa, Measuring 261). By removing the possibility of the site returning to a destructive industrial use, the possibility of further water quality degradation and soil contamination is negated. Furthermore, the greening of vacant properties reduces stormwater runoff by providing areas for water to infiltrate naturally and reduces the urban heat island effect by decreasing the amount of impermeable surface (Schilling). Urban green space is also responsible for "enhancing biological diversity, improving water quality, cleansing air, recharging aquifers, and controlling floods" (De Sousa, Brownfields 166). Native wildlife may also benefit from the increase in viable habitat, especially if the site is part of a larger green space network that may serve as a major wildlife corridor.

Social benefits

The community itself that surrounds the prospective park space may enjoy particular social and individual benefits. For example, they will have direct access to areas for both active and passive recreation thus allowing them to improve their physical health (Hardy 37). Additionally, if the brownfield is remediated properly, there will be a major reduction in health risks such as respiratory problems and other non-communicable diseases that are caused by exposure to hazardous materials (De Sousa, Measuring 266). In a survey conducted of over 500 park users in Indianapolis, the respondents "considered the impact of park space on people's health to be very positive" (De Sousa, Brownfields 164). Socially, improvements such as reduced violence and crime are possible. It has been proven that contact with nature is psychologically therapeutic and may reduce aggressive actions, which would then lessen the general sense of fear felt by residents in the neighborhood (Kuo). Lower crime rates and the residents' subsequent feelings of safety are important for the revitalization of the urban community. Furthermore, the conversion of a contaminated brownfield into a park space has the power to remove the stigma associated with derelict sites and encourage people to think differently about blighted areas of a lower socioeconomic status (De Sousa, Measuring 270). As Elizabeth K. Meyer states in Large Parks, remediated landscapes "[offer] the opportunity to change environmental attitudes, construct new constellations of social collectives, and prompt actions" (75).

Economic benefits

There are specific economic advantages of converting brownfields into park space, such as decreased rates of housing abandonment. People are less likely to desert their place of residence if it is located on a prominent green space. One reason for this is that real estate value of properties adjacent to green space is often higher than elsewhere in urban areas – often by approximately 20%. Higher values have been recorded for various brownfield projects in New


Jersey, where adjacent property values rose by an average of 86%. Interestingly, this increase in property value is typically higher for land surrounding parks programmed for passive recreation, rather than active recreation. Additionally, this economic benefit does not only apply to adjacent properties. Properties within 2000 feet of a park space larger than 40 acres can be expected to incur the same advantage (De Sousa, Brownfields 165-167). On a similar note, the redevelopment of one brownfield often triggers a snowball effect that causes the property values of adjacent brownfields to increase by nearly 50%. Consequently, higher real estate values result in a stronger tax base that can be used to improve the community's quality of life (De Sousa 270).

As far as businesses are concerned, "decision makers in small companies . . . ranked 'recreation/parks/open space' as their highest priority when asked to identify the quality-of-life elements influencing their business location decisions" (De Sousa, Brownfields 165). Because of this, the location of park space may encourage economic development and neighborhood revitalization in urban areas.

Despite these major economic advantages, it is clear that redeveloping brownfields can be quite expensive- primarily due to clean-up costs. Specific data regarding clean-up costs is unobtainable due to the wide range of brownfield sites and the amount of remediation needed for each particular property. However, if a brownfield is redeveloped into a park space, it is often built in phases, which then can be funded incrementally. This reduces the need for major funds from the start and increases the possibility of long-term success (Hardy 35). Furthermore, various government programs, such as Superfund and state-funded initiatives, can dramatically increase funding opportunities and therefore the success of the project.

One successful example of incremental funding and phased construction is Fresh Kills Park, a project designed by James Corner Field Operations. The 2,200-acre former landfill is primarily funded by the New York Department of State and the Department of Sanitation. The city has pledged a total of $100 million to complete Phase 1. Further funds will be acquired from environmental groups and private investors as construction continues. (Fresh Kills Park)

Bioremediation methods

While typical remediation methods such as capping, soil washing, air stripping, incineration, and hauling can be effective, they often result in negligent use of resources and a mere transfer of contaminants to other properties. In other words, they often mask the problem, rather than truly improve the air, water, and soil present at an industrial site. The alternative to these strategies is the use of bioremediation methods. They often require substantial field testing and monitoring but are usually most suitable for large sites (Simons 50). They can be employed in one of two ways: 1) ex-situ, which requires transportation of the contaminated materials and its subsequent return, or 2) in-situ, which involves treating the materials in the location in which they are found (Bonaventura).

Phytoremediation

Phytoremediation is defined by the EPA as the "use of various plants to degrade, extract, contain, or immobilize contaminants from soil and water" (De Sousa, Brownfields Redevelopment 168). It involves the in-situ removal of contaminants through the use of plants or microbes often known as hyperaccumulators. Usually, plants are installed over the majority of a site, and then removed after successful growth to then be incinerated or transported to a landfill. This bioremediation method is particularly attractive because it uses a plant's natural ability to absorb and weaken detrimental substances and severely decreases the total mass of hazardous waste to be disposed of. Also, it can often be cheaper than conventional techniques (see Figure 3), costing approximately $5-40 per ton, compared to $100-500 per ton for chemical treatments (EPA 6) and leaves valuable topsoil in usable condition. Furthermore, it decreases the risk of exposure to hazardous materials during the remediation process since the site is covered in plant material, rather than bare, contaminated soil subject to erosion. However, despite these distinct advantages, it is a time-consuming process that requires a lot of patience due to the relatively slow nature of plant growth. One can expect to see substantial reduction in contaminants after a minimum of three growing seasons (Dirt). Unfortunately, this disadvantage causes most developers to frown upon this strategy. Furthermore, there is a risk to wildlife if organisms ingest the plants on the site. More research must be done on how this can affect the entire food chain but it is evident that some inherent risk of bioaccumulation is involved (Black 1107). Another concern for the success of this method is the quality of the soil and its infiltration rate, temperature, and amount of biomass present (McGowan 6).

It is also clear that phytoremediation is not a successful method unless the appropriate plants are used to treat the appropriate contaminants. Studies show that there is a range of plants that are tolerant of high heavy metal concentrations, which makes them appropriate for use in remediation of derelict industrial sites in particular (Bonaventura 9). Some examples of appropriate species include: *Thlaspi caerulescens* (alpine pennycress), *Ipomoea alpine*, *Haumaniastrum robertii* (copper flower), *Astralagus racemosus* (creamy poison-vetch), and *Sebertia acuminate* (EPA 11). Plants from the genus Brassica, to which broccoli, rape, turnip, and Indian mustard belong, grow even faster and can absorb even more contaminants than those previously mentioned. Poplar trees are also often used for their ability to break down carcinogens and groundwater contaminants (Black 1107). Overall, phytoremediation is an effective

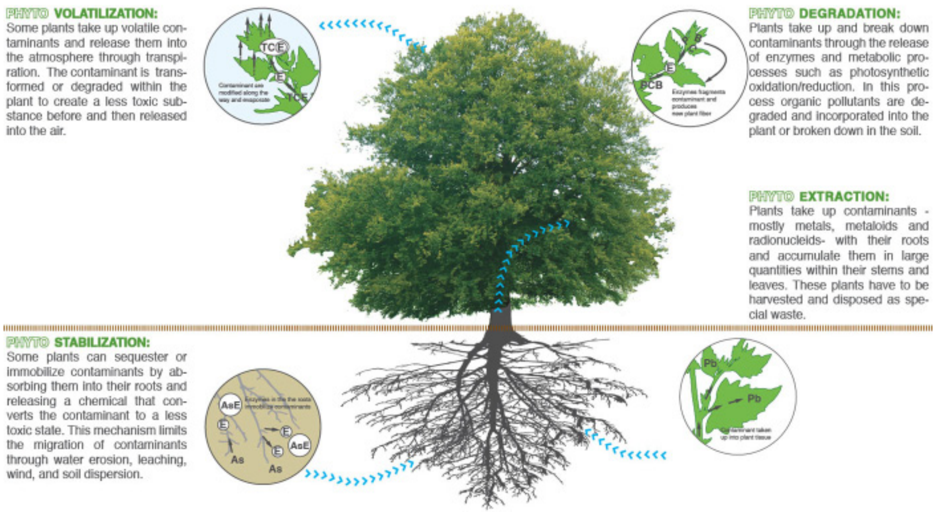


Figure 2.

Left: Figure 2 - Process of phytoremediation.
Below: Figure 3 - Cost comparison.
Both images from *youarethecity*'s “Brownfields to Greenfields: A Field Guide to Phytoremediation”

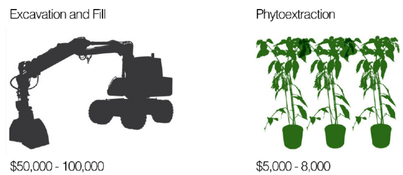


Figure 3.

technique and would be an appropriate strategy to clean up the proposed site. It is also an intriguing option since the remediation phase and design phases can be combined as the plant material used for cleaning up the site can remain as part of the final design.

Phytoremediation has been successfully implemented on several large corporate properties, including the Ford Motor Company's Rouge Plant near Dearborn, Michigan. With the help of Clayton Rugh, a biologist at Michigan State University, architect William McDonough and landscape architect Julie Bargmann applied the practice of phytoremediation over the manufacturing site that included a coking operation for over 80 years. After testing 50 plant species for their ability to draw up contaminants, the 22 best were planted throughout the site, resulting in a decrease in PAH (polynuclear aromatic hydrocarbon) levels by 20-40%. Interestingly, the plants seem to be removing contaminants 20-50% faster than they did in test plots filled with transported soil. The fact that large corporations have strived to implement this strategy and have been met with success is encouraging for its use in other projects. (Dirt)

Biostimulation

Another possible bioremediation method is biostimulation. This involves the addition of nutrients and chemicals to promote the efficiency of existing soil components such as bacteria. It effectively encourages soil health and is an in-situ method; however, it is often implemented through the use of injection wells which necessitate some site disruption (Bonaventura 11). For this reason, this method is best employed early on as a soil treatment prior to major redevelopment.

Constructed wetlands

In contrast, the integration of constructed wetlands in site remediation is more encouraging. Constructed wetlands are artificial structures filled with water-loving plants (such as bulrush, cattails, arum, blue flag iris, common reed, and sedge) and algae that encourage the growth of helpful microbes (Davis 30). As these organisms grow and mature, they effectively extract and filter contaminants through the use of porous substrate (sand, gravel, rock) and a mixture of plant material, both of which rest on an impermeable liner. The plants are important as they increase the amount of surface area that is in contact with the contaminants, thus improving transpiration and filtration rates. These structures are most commonly used to treat waste water and coal mine drainage, but they are also particularly effective at extracting metal contaminants present at industrial sites (Davis 11). It is also an effective strategy since transport of the materials is unnecessary, the site is hardly disturbed, and it requires little effort (Bonaventura 15). Furthermore, operation and maintenance costs are minimal and their resulting aesthetic value is high due to their ability to fit into the existing landscape (Davis 28). However, monitoring of the process is difficult and its success requires insightful design and substantial scientific expertise. Overall, the use of constructed wetlands in the remediation of industrial sites is effective due to their ability to successfully treat waste water that would otherwise proceed to contaminate other properties. It embraces the use of gravity and encourages processes that occur naturally. (Bonaventura 15-16)

One example of a successful constructed wetland project is Don Valley Brickworks Park in Toronto, Ontario, where wetlands were installed in order to both provide important aquatic and wildlife habitat and to ensure that the water flowing into the Don River and further into Lake Ontario would be of the best quality.


Constructed wetlands


Biostimulation


Landfarming

In 1889, the 41-acre site was first used for the production of important building materials that were made to build many of Toronto's famous landmarks. One century later, the owners abandoned the site now ridden with toxic solvents and oils. Today, a series of ponds treats the water filled with these substances by first extracting sediment and then allowing the water to continue flowing through ponds where it can be remediated biologically. Habitat now flourishes there and water is successfully and naturally treated for all to see. (Vitello)

Landfarming

One last possible bioremediation method is called landfarming. In this process, the contaminated soil and/or water is removed and transported to another site where it is tilled, aerated, and spread over a large area. The intent is that these actions will dilute the contaminants and make them more vulnerable to natural bacterial processes in the soil at the dedicated remediating site. While effective, the removal and transport can be costly and the treatment requires an amazingly large amount of land, often in rural areas. Whether or not the treatment is predominantly cost-effective is also a concern (Bonaventura 12). Because of these concerns, this method should be avoided if at all possible in favor of more sustainable treatments.

A final note

No matter the bioremediation method chosen, however, it is clear that the use of one– or the combination of several– methods can be valuable to the natural environment. They all encourage the use of natural processes and allow a healthier treatment of the urban environment for all. Additionally, employing a combination of methods in phases is a particularly attractive option considering each method's respective advantages. Some would be most effective prior to development, while others can continue to function while the site is actually completed and open to users.

Opportunities & constraints

The former Citizens Energy coke plant site in southeastern Indianapolis is comprised of over 140 acres divided into 4 separate industrially-zoned parcels. The plant's construction began in 1908 and the plant at one time provided all the gas needed to heat Marion County. Despite success through the 1980s, the plant was eventually closed in the year 2007 and has since remained untouched. It is now a part of Indiana's Voluntary Remediation Program. (Peoni)

Immediately surrounding the site is a primarily residential area whose vitality has been declining since the 1970s during which Interstate 65 was constructed. This development led to the destruction of many homes and businesses and effectively divided the community that once resided there into disconnected segments. A growing disinterest in urban revitalization compounded the problem as people fled to the suburbs, worsening the state of the existing urban neighborhoods of Indianapolis. Being a mere 2.7 miles from Monument Circle downtown had little effect on the area. However, recent developments provide hope for the neighborhood as the Southeast Neighborhood Development (SEND) group has led projects that have increased property values by nearly 90%. Also, the redevelopment of Fountain Square, a commercial district within the SEND focus area (see Figure 6), has been designated one of Indianapolis six Cultural Districts (History).

Despite these victories, there is still a lot of work to be done. Land values are still considerably low and the local population is slowly decreasing in numbers (Proposed Reuse Vision). Moreover, while the site needs intensive remediation, many developers will not eagerly fund expensive clean-up efforts without the hope of acquiring a profit. With low land values, there is little hope for developers to remain satisfied with their investment. However, following the development of park space on this site, the area can expect to benefit from higher land values and an improved quality of life. The new park space provides the opportunity to inspire even greater improvement in the surrounding community, only encouraging further growth.

The sensitive redevelopment of the site has the opportunity to provide services for the local community that are currently underserved. For example, Indy's southeast side has much less public green space than other quadrants of the city which leads to lack of recreational opportunities (Peoni). In fact, Indianapolis as an entire city ranks very low for the percent of park space with only 4.5%. In comparison, the national average is 9.6% (De Sousa, Brownfields Redevelopment 160). Among some of the local community's suggestions for amenities are the integration of sports fields, a sledding hill, a spray park, etc. (Citizens Energy Group). Beyond recreational services, the site's redevelopment may inspire the formation of a true community identity which is currently absent. And as mentioned earlier, the location of green space has the ability to inspire a reduction in crime and housing abandonment rates and an increase in property values (Peoni).

The site itself poses distinct challenges for redevelopment. First, there are obvious demolition and remediation requirements due to the plant's long industrial history. Citizen's Energy Group, who maintains ownership and primary responsibility for the site, intends to demolish all structures on the site within a period of 3 years and intends to implement all remediation and redevelopment strategies through the year 2024. This long time span puts the project's significance and seriousness

Figure 4.

Figure 5.

Figure 6.

Upper Left: Figure 4 - A distant site view.
Above: Figure 5 - Fountain Square, a major social landmark of the area.
Left: Figure 6 - SEND's (Southeast Neighborhood Development) boundary which includes Fountain Square and the MGP site.

into perspective. Due to the amount of work needed, Citizen's Energy Group has employed the help of the Indianapolis Department of Metropolitan Development and Indy Parks and Recreation in order to ensure the success of the entire project. All groups involved support the idea of a phased process for remediation and redevelopment. (Proposed Reuse Vision)

While Citizens Energy Group believes that a majority of the site should maintain the zoning distinction 'industrial', the Department of Metropolitan Development has suggested the development of a regional park on this property. They believe that it could provide important recreational access for the community, buffer surrounding neighborhoods from industrial properties to the south, and protect the historical plan for Indianapolis created by George Kessler in 1908 – ironically, the same year the coke plant was first constructed. Incorporating Pleasant Run into the design, which runs directly through the proposed site, is also an important opportunity (Peoni). Additionally, their proposal highlights the specific need for meaningful connections into the surrounding community.

Problem Statement

The purpose of this project was to explore the benefits of reclaiming an urban brownfield for the development of a park space, to identify the specific environmental concerns of reclaiming an abandoned coke plant, to determine the bioremediation methods that would be most effective in cleaning up such properties, and to identify opportunities and constraints of the site. Based on these findings, this project proposes a park master plan for the former Citizens Energy coke plant in southeastern Indianapolis.

Sub-problems:

1. What are the specific environmental concerns of an abandoned coke plant?
2. What are the benefits of reclaiming urban brownfields for park space?
3. Which bioremediation methods could be integrated into the park design to effectively clean up the property?
4. What are the opportunities and constraints for park development?

Project Significance

PROPERTY EVOLUTION

1941

1962

1979

1991

2001

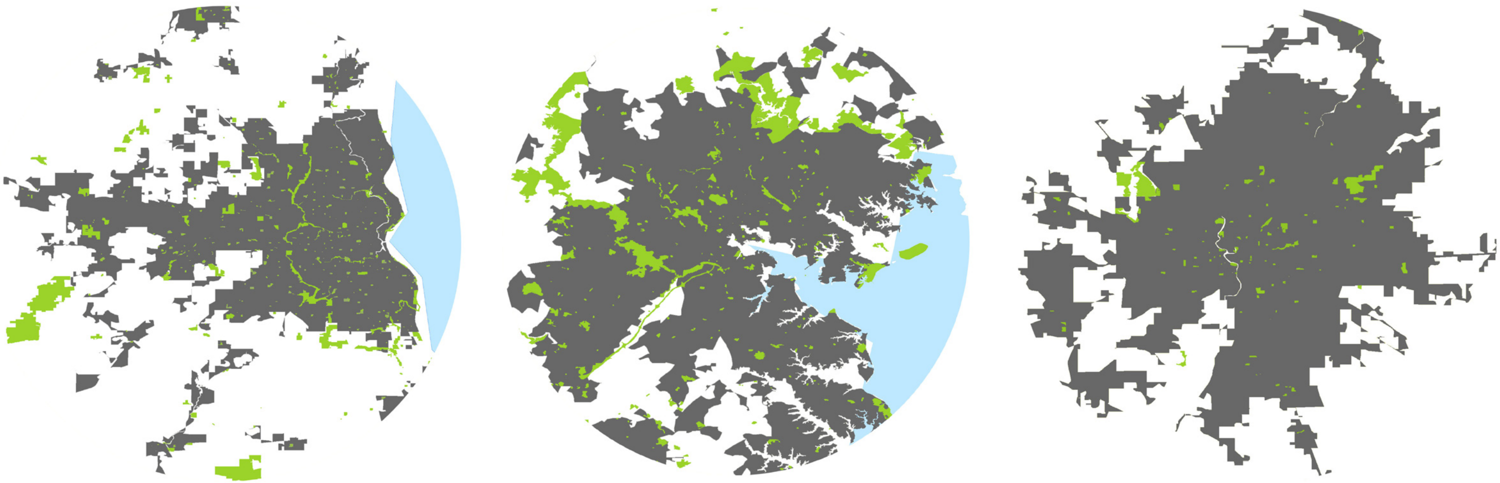
2010

Why can't parks built on brownfield sites make us more aware of our wasteful ways and encourage a more insightful way of living?

Our experience in and treatment of parks in today's world is strikingly different from that of our predecessors. While designers of the past dramatized the beauty of nature in picturesque landscapes and relied on nearly untouched lands, landscape architects today are confronted with unforgiving environmental issues and derelict properties that are direct representations of our society's habit for overconsumption. Our cities have morphed from bustling industrial centers into decaying monuments to the revolutionary age of the past. Because of this, designers today have an opportunity to reflect on the Industrial revolution and represent our society through truthful eyes. Why can't parks built on brownfield sites make us more aware of our wasteful ways and encourage a more insightful way of living?

This project has the ability to inspire a new treatment for underappreciated properties in the Indianapolis area- of which there are many- and elsewhere. It encourages the integration of ecology and art as the site is remediated through technical but artful means and may propose an ecological framework from which other designs can stem from. Furthermore, this site restores the long-lost identity of the southeast side, a part of Indianapolis that has struggled throughout the history of the city, as well as reenvisions Indianapolis' network of quality green spaces, of which there is a low percentage.

The Park Space Debate

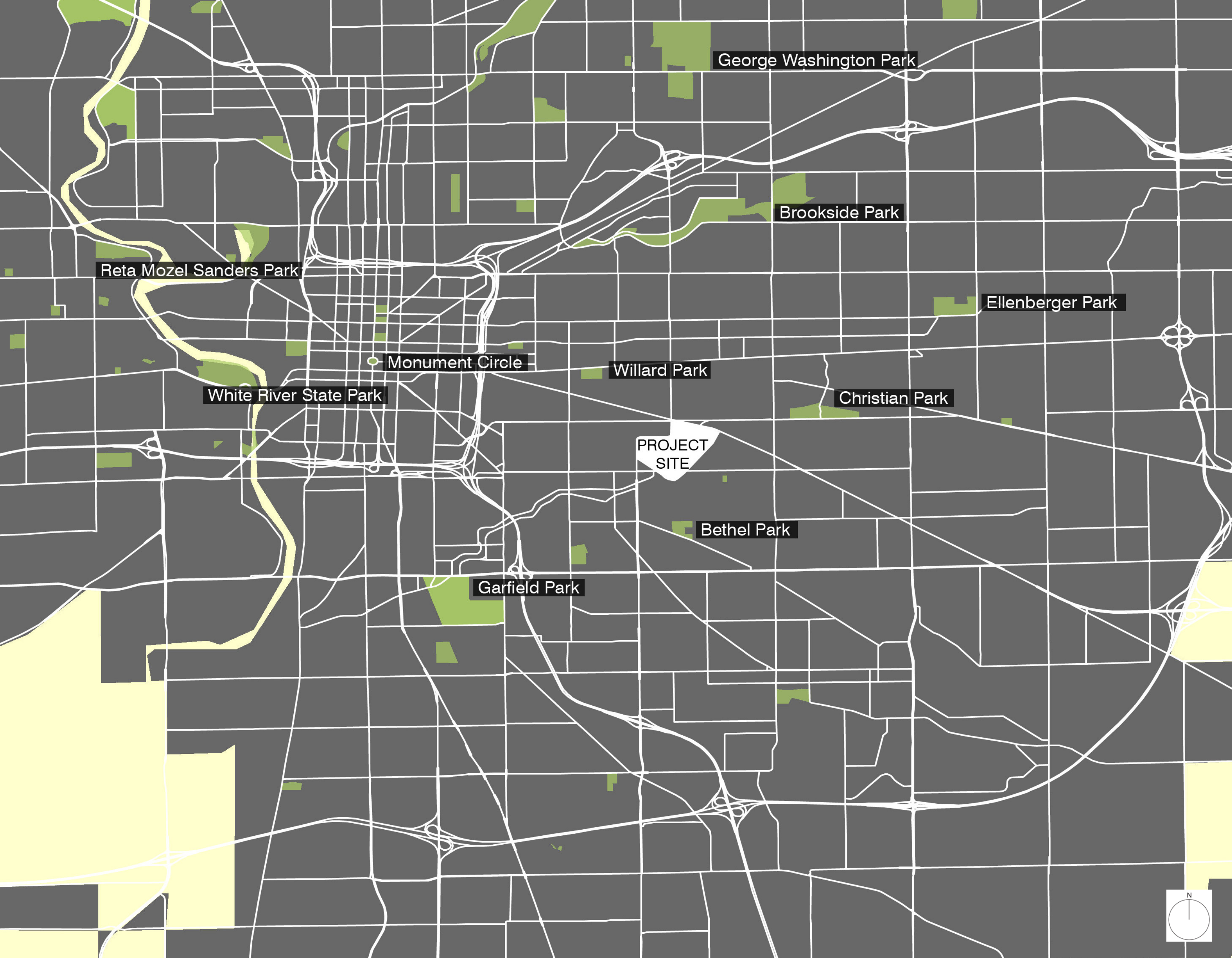


Milwaukee
Population: 573,358
Land area: 96 sq. mi.
People per sq. mi.: 6,214.6
Park acres per 1000 people: 16
% park space: **9.5%**

Baltimore
Population: 637,418
Land area: 80.80 sq. mi.
People per sq. mi.: 8,038.9
Park acres per 1000 people: 7.5
% park space: **9.2%**

Indianapolis
Population: 785,597
Land area: 361 sq. mi.
People per sq. mi.: 2,163.0
Park acres per 1000 people: 14
% park space: **4.7%**

Interestingly, both Milwaukee and Baltimore have similar population sizes to Indianapolis and can be easily compared. However, both cities have nearly double the amount of park space and incorporate it much more effectively into the urban fabric. Even though Indianapolis has over 200 parks within the city, it is clear that equal distribution of park space that does exist is extremely lacking, leaving people without sufficient spaces for recreation and relaxation on the southeast side. Also note that the project site is in prime position to support this kind of development as it will be a major recreational space for underserved local community. It is the missing puzzle piece.


George Washington Park
Brookside Park
Reta Mozel Sanders Park
Ellenberger Park
Monument Circle
Willard Park
White River State Park
Christian Park
PROJECT
SITE
Bethel Park
Garfield Park
N

Project Requirements

As a large park project within Indianapolis, it is clear that certain goals and requirements must be met. First, it must provide for the appropriate audience and effectively serve the community. It also must address major environmental and social issues. And finally, the project must be implemented with a look toward the future as our society's needs constantly shift. This section will dive further into the details of these goals and requirements.

Project goals

1. Improve the existing site **environment** to encourage a healthy ecosystem.
   Integration of bioremediation methods to clean contaminated soils and water.
   Protect the Pleasant Run corridor for habitat.

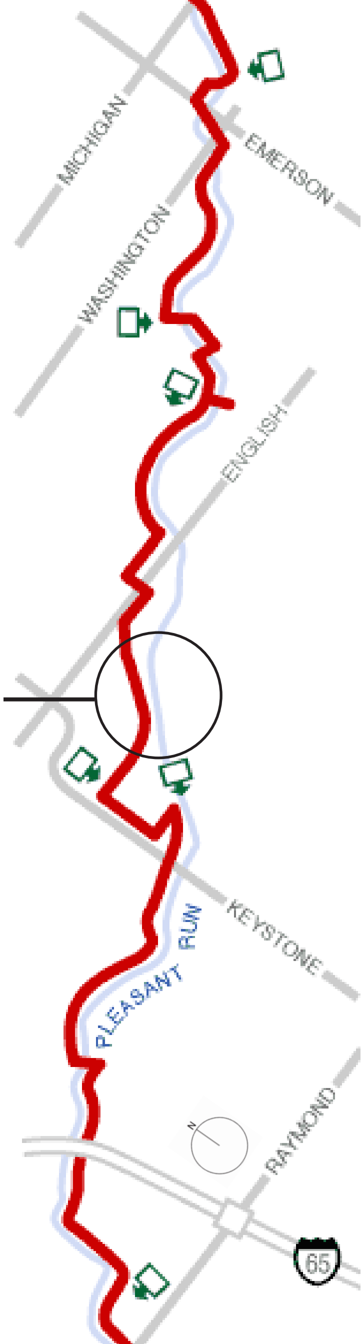
2. Inspire **revitalization** of the surrounding area.
   Allow easy access to the site.
   Establish meaningful connections with existing elements.
   Encourage economic growth.

3. Provide opportunities for **recreation**.
   Realign Pleasant Run greenway.
   Incorporate sports fields and passive recreational spaces.

4. Emphasize the **history** of the coke plant & surrounding neighborhood.
   Use existing buildings and structures.
   Program activities and spaces to incorporate southeast Indianapolis history.

5. **Educate** the public in order to remove the stigma from the site.
   Provide environmental education programs.
   Encourage public involvement through the design and construction process.

Site's location along the Pleasant Run Greenway




Contamination found on the site.


Pleasant Run Greenway.


A typical home in this area.


Local residents in Christian Park.

Site Issues

1. Extensive amount of remediation needed
2. Maintaining users' safety
   dangerous contaminants
   complex industrial equipment
3. Possible crime around and vandalism of the site
   active programming
   maintenance of distant views
4. Protection/restoration of natural systems
   phytoremediation & constructed wetlands
5. Pedestrian & vehicular access
6. Realignment of Pleasant Run greenway
7. History of Indianapolis' southeast side
8. Desired park amenities

Clients & users

As **Citizens Energy Group** still owns the property and is seeking a logical land use solution in conjunction with the Voluntary Remediation Program, one can consider them as the direct client for this project.

However, it is clear that this site will serve **the community** at large, thus emphasizing the necessity to design for the users rather than the owner of the property. The majority of the residents of the southeast side are of lower socioeconomic status and are often neglected by the city. It is their needs that must be met first.

The **environment** is also an obvious client since the remediation and revitalization of the natural systems on the site are of a high importance.


Programmatic Elements

To provide important recreational opportunities and open space, to educate the community, and to revitalize the environmental state of the site, the following amenities are included in the final design, to be discussed in further detail:

- sports complex
- community gathering spaces
- educational facilities & museum
- remediation zones
- realigned greenway & trail system
- improved commercial center

Programmatic Elements

1 Trail network & realigned greenway

The realignment of the Pleasant Run Greenway is a main priority of the brownfield redevelopment. It is a backbone that will connect this park space to surrounding park spaces and recreational amenities throughout the city. Establishing an internal network of trails radiating off of this greenway will encourage pedestrian circulation and allow local residents to efficiently access the park from all directions.

2 Educational facilities & museum

As the primary goal of this site is to educate the public on environmental issues and industrial history, the facilities for this education to occur in is of utmost importance. The diagram to the left portrays the variety of structures that may remain on the site and be reused as either monuments or educational facilities. The gas holder frame, the plant's administrative buildings, and various other heavy industrial structures represent just a few of these iconic structures to be reused.

3 Improved commercial center

On the northwest part of the site, a typical suburban commercial center exists. It includes businesses like the following: grocery, hardware, nail salon, etc. As it provides for the local residents, it will remain on the site but will be improved to reflect the aesthetic of the rest of the development. Its existing 'sea of asphalt' will be infused with nature to create a much more enjoyable parking environment.

❹ Community center & recreation complex

Currently, local residents are forced to drive a vehicle to other Indianapolis parks in order to enjoy a variety of facilities that can not be found closer to their homes. This lack of opportunity for pedestrians is a major issue. Therefore, a community center and active recreational facilities will be provided to better serve the local community. Basketball courts, baseball diamonds, soccer fields, and a football field/track are just a few of the amenities that will be created in conjunction with a central community center. Children and parents will now be able to access facilities on foot, rather than by car.

❺ Remediation Zones

At the heart of this redevelopment is the obstacle of remediation. As the site is heavily contaminated, maintaining park users' safety is a primary concern throughout the design and construction process. Because of this, the integration of various bioremediation methods (discussed in the Background section) is central to the park's design.

Poplar & birch groves:

These dense plantings quickly hyperaccumulate heavy contaminants and can also provide a pleasant aesthetic throughout the park.

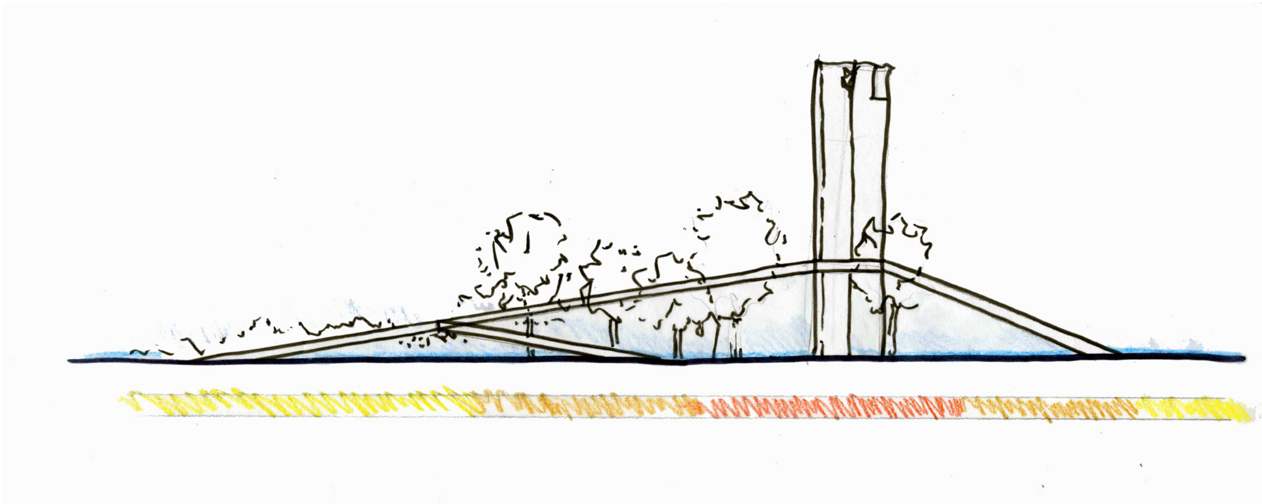
Constructed wetland:

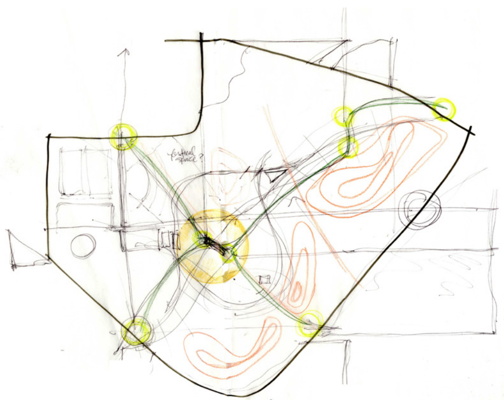
As filtration of the water is just as important as the cleansing of the soil, a constructed wetland can facilitate this process and can also serve as an educational opportunity for visitors. The accessibility and transparency of the water filtration process is a particular advantage.

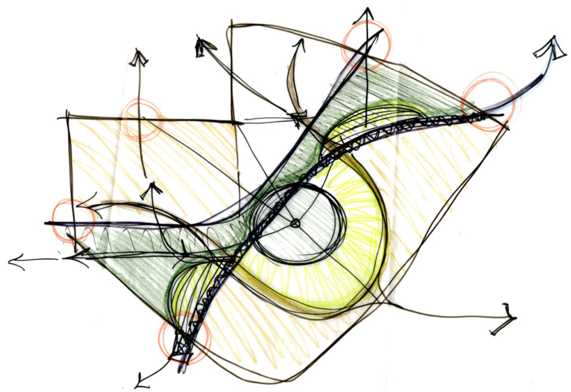
Strategic plantings:

A variety of low-maintenance, perennial plantings will provide further remediation as well as an improved aesthetic. The reintroduction of small wildlife is also made possible by this amenity.

Design Process

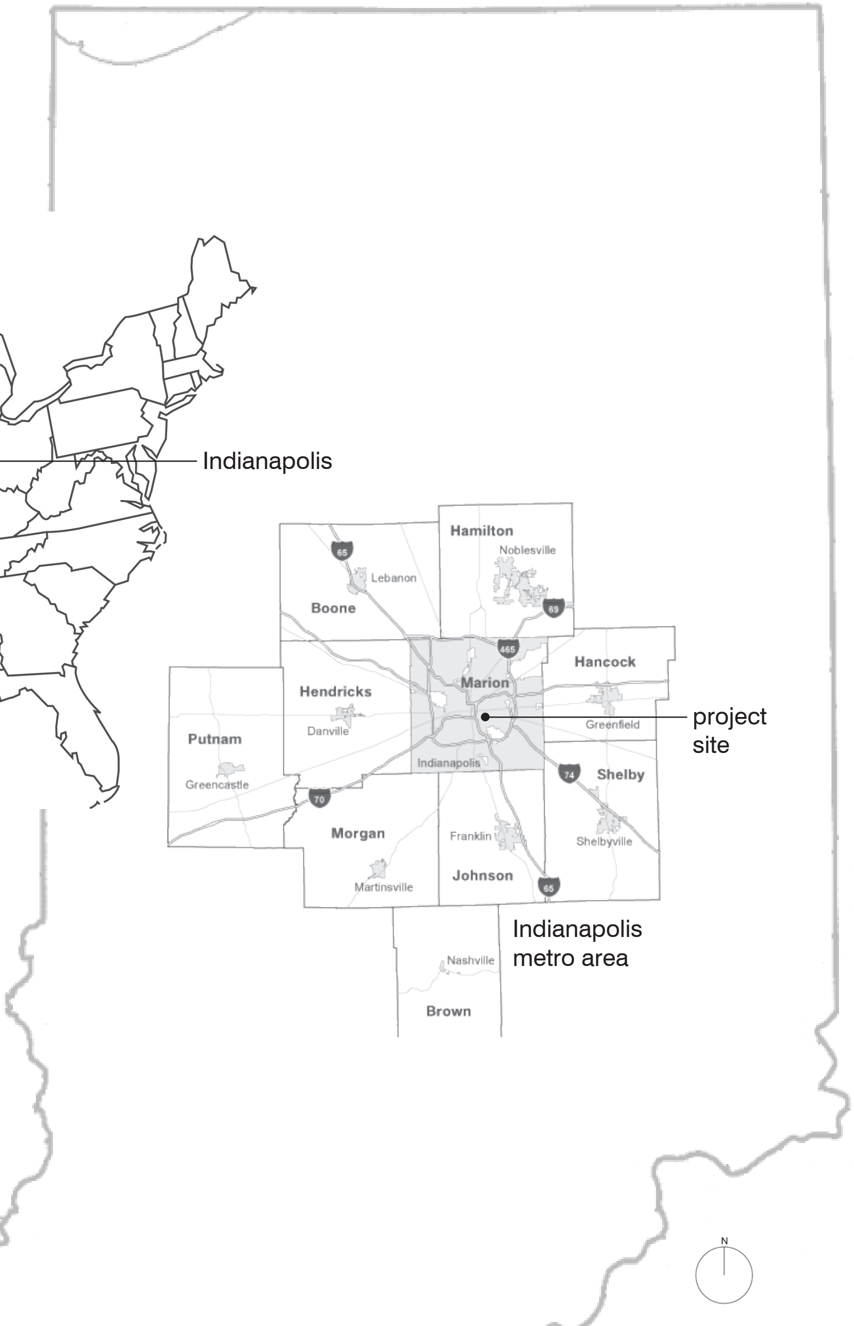






The design process followed a logical pattern from site inventory and analysis through final master planning, site planning, and construction details. Each are thoroughly presented and described within this section.

Location



The site is located on the near southeast side of Indianapolis, seen here on the maps provided. Its location directly on Pleasant Run Creek is a major asset as it connects the park space with the greater Indianapolis parks system which includes the Pleasant Run Greenway. Furthermore, the short distance to Monument Circle in downtown Indy is a great advantage as it is just 2.6 miles to the heart of the city. Lastly, as stated before, the site is situated in such a place as to provide for the underserved community on the southeast side.


Interstate 70
Interstate 65
Keystone Avenue
Monument Circle
English Avenue
White River
Project Site
Interstate 70
Prospect Street
Southeastern Ave
Interstate 65
N

Past efforts

As a participant in the state Voluntary Remediation Program which was established in 1993, Citizens Energy Group is actively pursuing remediation and redevelopment of this site. Not surprisingly, they envision maintaining an industrial use for the majority of the site. The Group designates the Twin Aire parcel as possible park space, the Southeastern parcel for mixed-use development, while maintaining an industrial use for the remainder of the property.

In contrast, the Indianapolis Department of Metropolitan Development, in conjunction with Indy Parks, has presented the idea of converting the majority of the site into park space alone, with adjacent parcels for higher density residential development than currently exists in the area.

While the vision of Citizens Energy Group is realistic, the plan set forward by the DMD is much more ambitious and would benefit the community much more in the long run.

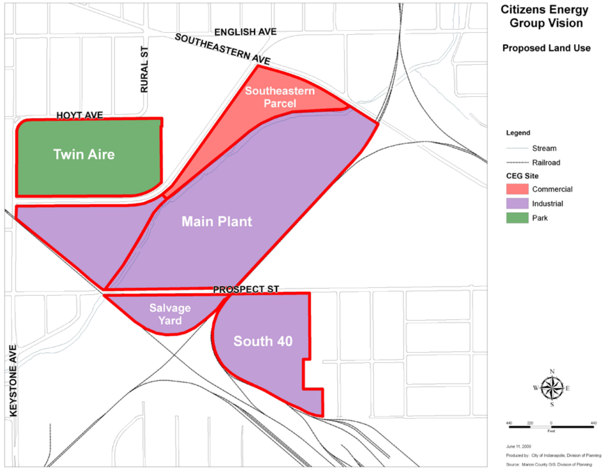


Figure 7.

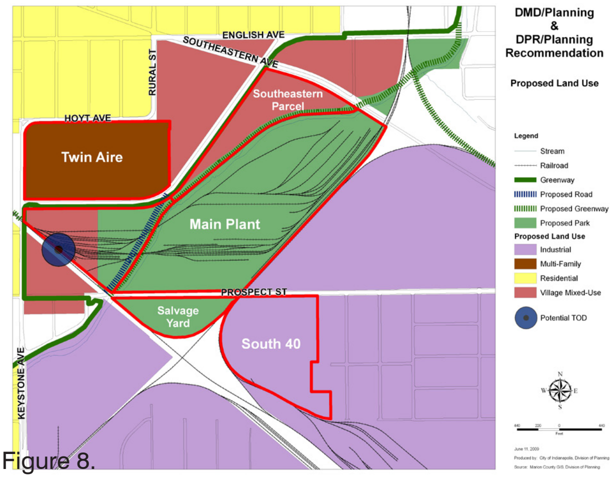


Figure 8.

Upper left: Figure 7 - Citizen Energy Group's land use proposal.
Bottom left: Figure 8 - DMD's recommendations for the site.
Opposite, top: Figure 9 - Inorganic contaminants in the soil.
Opposite, bottom: Figure 10 - Organic contaminants site survey.

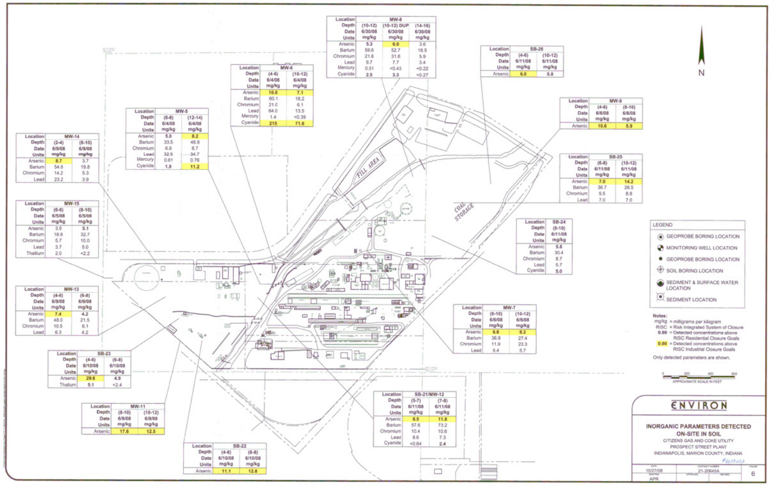


Figure 9.

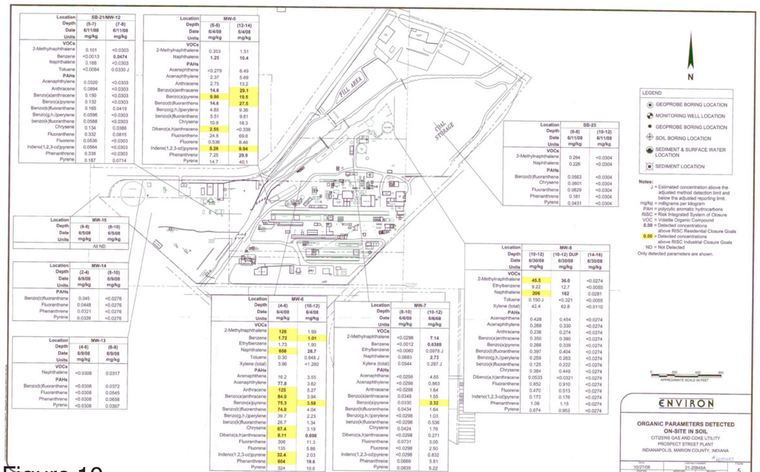


Figure 10.

The images to the left represent the environmental studies that have already been conducted as Citizens Energy Group moves through the beginning stages of the remediation process. Please note that the site contains very dangerous chemicals and materials used in (or a byproduct of) the coking process. These include but are not limited to the following:

arsenic
cyanide
benzoanthracene
benzopyrene
methylnapthalene
anthracene
phenanthrene
napthalene
benzene
barium
chromium
lead
mercury
thallium

Existing Conditions

Since it was effectively abandoned in 2007 when it closed due to a failing market, the Citizens Energy manufactured gas plant has sat vacant and primarily unattended. However, there are some unique structures and spaces that can be highlighted and converted into very functional amenities. But first, take a look at what the site looks like today.




1 greenway diverted from the creek
2 existing brick buildings
3 coke utility building in poor condition
4 admin. buildings adjacent to gas holder frame
5 gas holder frame
6 separation of rail lines
7 Pleasant Run Creek through the heart of the site
8 active rail line on southern site boundary

Analysis

1 Circulation
Currently, Pleasant Run Greenway must circumnavigate the fenced facility. This important component of pedestrian circulation must be addressed to restore public access. Reaching into surrounding neighborhoods is also an important strategy for restoring access.

2 Active rail
Active rail lines along the southern site boundary is a major barrier for circulation, as well as a hazard for park visitors.

3 Industrial structures
Some structures are iconic and remain in good condition. These (shown in dark gray in Figure 12) may remain for new purposes. Those shown in light gray, however, should be demolished as planned.

4 Old drive-in theater
A parcel at the northwest side of the site was once a popular drive-in movie theater. It has the flattest topography overall and hints of old roads still remain here, as well as the foundation for the old movie projection house.

5 Coal storage
The land on the northeast side was once where mounds of coal were stored. This served as the raw material for the coking process. Because of this use, there is interesting rolling topography here.

6 Visual connections
Most of the industrial structures are prominent and towering. Therefore, maintaining sight lines to them should be a priority - not only for aesthetics and monumentality, but for pedestrian wayfinding as well.

Below: Figure 11- Land use study.
Opposite: Figure 12 - Site analysis.

Land use

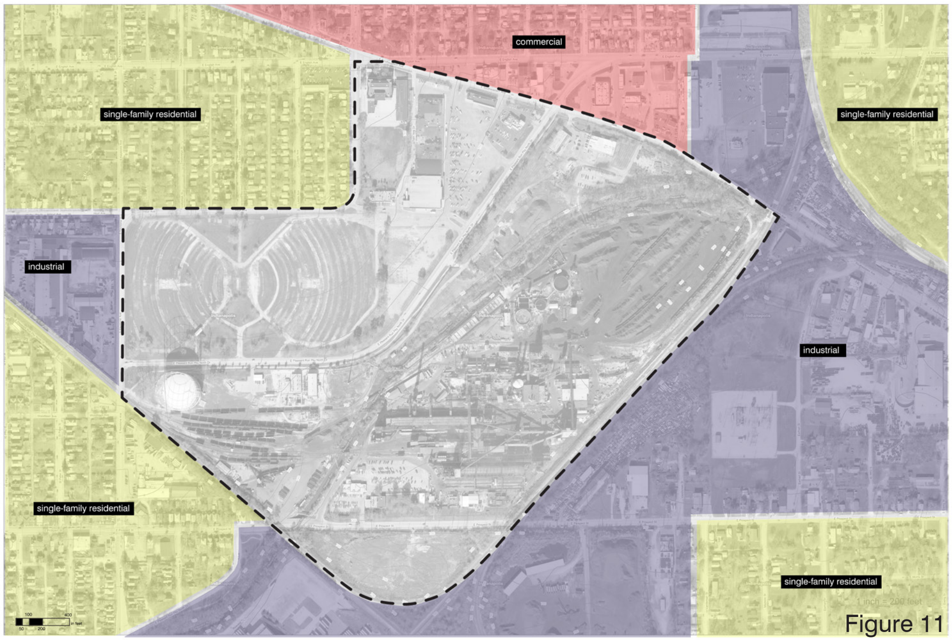
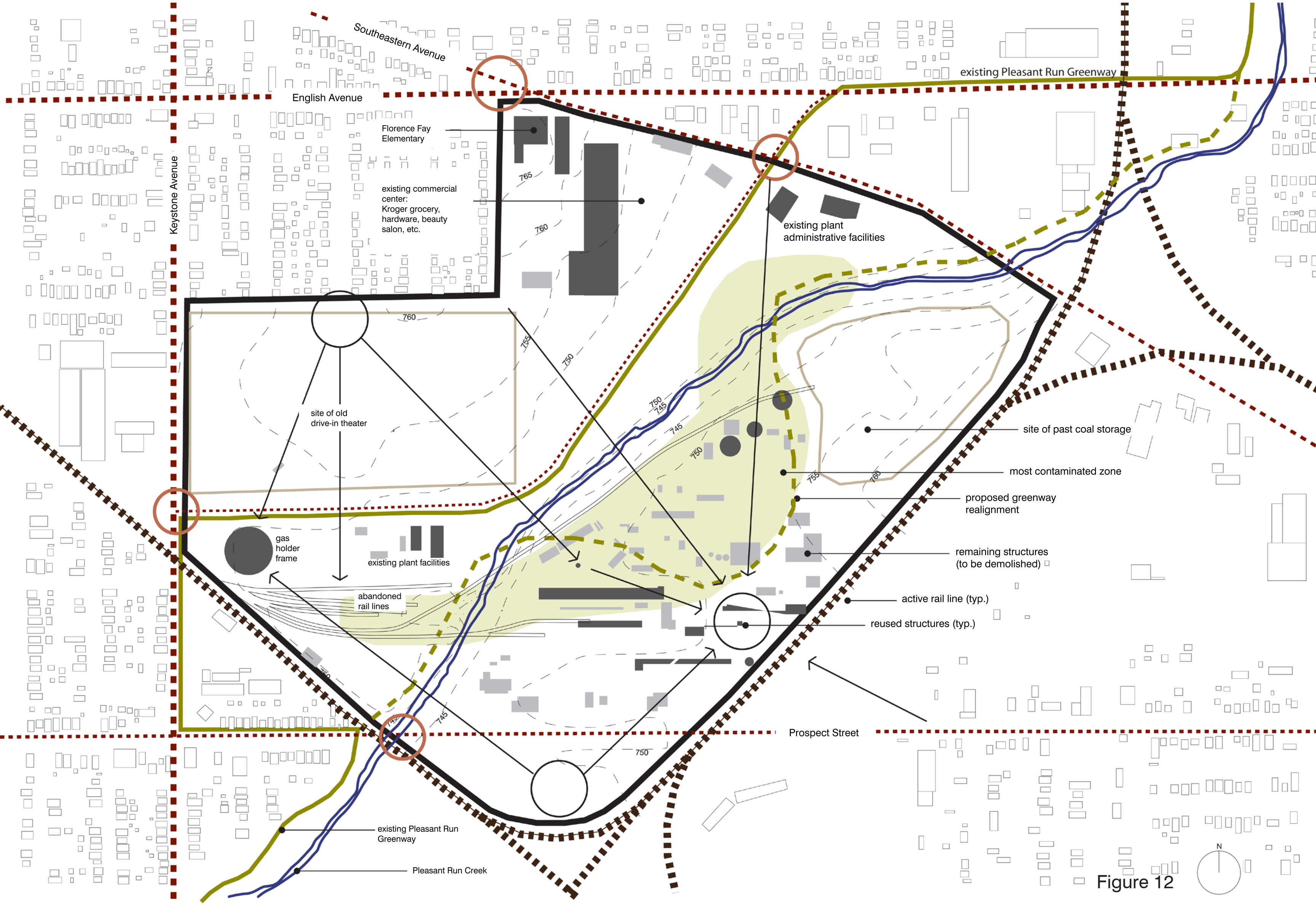


Figure 11



Southeastern Avenue
English Avenue
existing Pleasant Run Greenway
Keystone Avenue
Florence Fay
Elementary
existing commercial
center:
Kroger grocery,
hardware, beauty
salon, etc.
existing plant
administrative facilities
765
760
760
755
750
750
745
745
750
755
760
745
745
750
site of old
drive-in theater
gas
holder
frame
existing plant facilities
abandoned
rail lines
site of past coal storage
most contaminated zone
proposed greenway
realignment
remaining structures
(to be demolished)
active rail line (typ.)
reused structures (typ.)
Prospect Street
existing Pleasant Run
Greenway
Pleasant Run Creek
N

Figure 12

Case Studies

The case studies presented here provided a great range of inspiration for the entire project due to their use of natural systems and sensitive design. Clearly inspiration was drawn from all sorts of designs and places. The four presented here were the most influential and noteworthy as it pertains to my project.

Gas Works Park: Seattle, WA
Designed by Richard Haag
19.1 acres
Open to the public in 1965
Former Seattle Gas Light Company

The classic post-industrial site turned park, Gas Works Park highlighted the structures as ruins and monuments and employed phytoremediation at a time when little was known about the topic.

Don Valley Brick Works: Toronto, ON
Designed by: du Toit Alsop Hillier, Diamond+Schmidt Architects Inc., Claude Cormier Landscape Architects
16.5 acres
Open to the public in 1997
Former quarry and industrial site

The way in which the site has been transformed into an educational tool is one reason it has been so effective. Furthermore, the use of wetlands and ecological restoration to portray the site's past and future is particularly impressive.

Riemer Park: Munich, Germany
Designed by: Latitude Nord
Open to the public in 2006
Former Munich airport
Former quarry & industrial site

This modern, minimal park's use of open space is particularly refreshing as it allows for a great amount of passive recreation. It is amazingly low-maintenance due to their use of perennial plantings of natives and contaminant absorbers.

Fresh Kills Park: NYC
Designed by: James Corner Field Operations
2,200 acres
To be completed over next 30 years
Formerly the world's largest landfill

This massive park space is a grand challenge but one worth paying attention to. Ecological restoration is the backbone of the design as it provides the framework for highlighting various environments throughout. Field Operations successfully incorporated a wide range of activities to provide for a large and diverse population.

Conceptual development

Transformations

Each zone on the property is an opportunity for transformation. There can be a new, meaningful identity for each area, leaving nothing left unimproved.

1

mounds of raw coal product created a varied topography and distinct character of the land.

mounds of lush lawn and vegetation become a child's playground.

2

derelict & abandoned structures sit remain, portraying the site as ugly and unused.

structures remain despite intense remediation occurring around them. public interaction with industrial structures.

3

storage and transportation areas of processed industrial coke present opportunities for structure reuse.

rail lines and terracing allows visitors to visually connect with the history of the site and be led further inward.

4

old drive-in theater site has remained purposeless and vacant for years.

recreation takes over as the activity here, allowing surrounding residents to exercise, connect, & make use of the land.

5

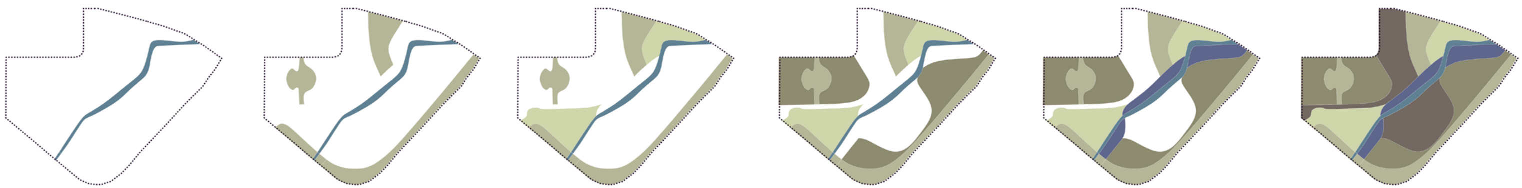
commercial strip mall surrounded by a sea of asphalt.

infusion of natural elements. improvements made to the parking environment.

Figure 13

Phased Development

It is important for community access to be maintained throughout the park's construction since its remediation will likely be a lengthy process. Figure 14 below shows how this might occur by highlighting which part of the park may open in succession.



the existing site is a closed gas plant, without public access or amenity →

within a few years, areas of the site can be reclaimed as community amenities, such as the realigned greenway, event lawn, and plaza →

soon thereafter, new educational facilities can provide residents with a link to their industrial past and environmental future →

larger areas of the park will be reclaimed as public parkland over time, for both active and passive recreation →

the river banks will finally allow public access after being remediated and regraded →

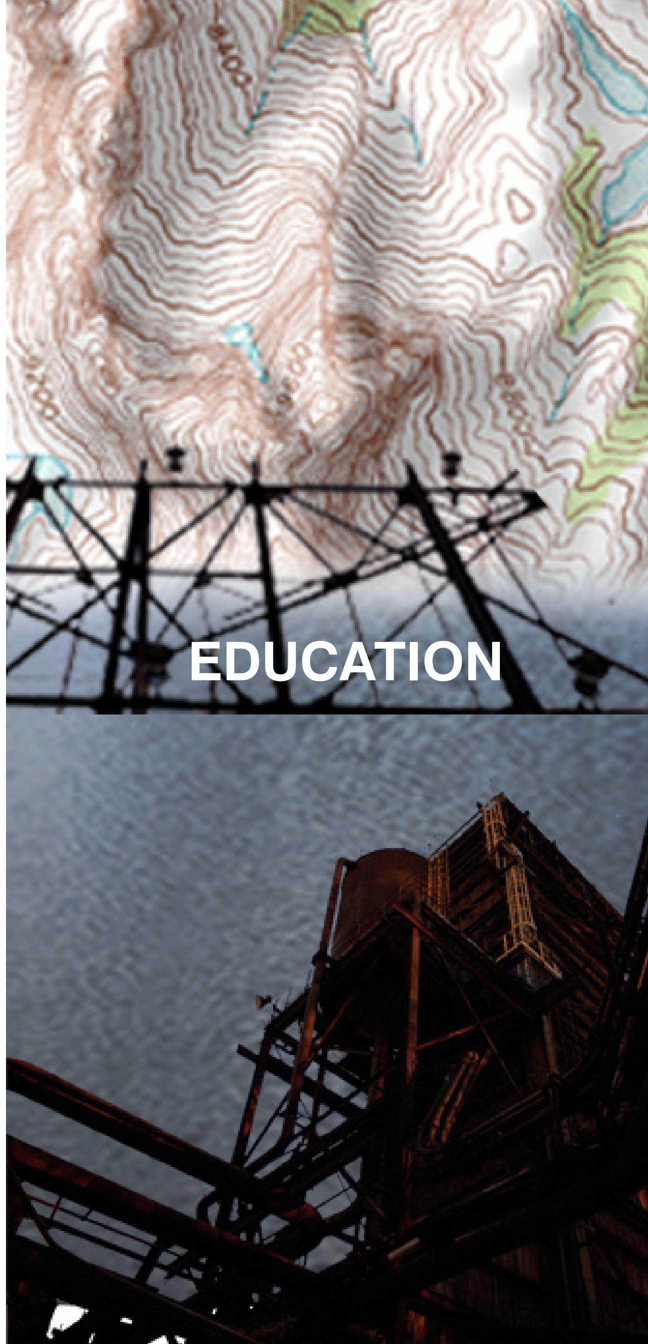
a mature regional park within the next 2 decades, the manufactured gas plant will continue to evolve and grow

Figure 14

Topography
Rediscovering the river
Encouraging interactino with water

Water
Use of landfrom to portray remediation of site
Encourages park users' safety
Dynamic & artful

Industry
Portrayal of industrial history
Reuse of large structures as monuments
Visitors indirectly & directly learn



Master plan

The master plan (Figure 16) combines all the information gathered about the site to portray a complete picture of what this abandoned property could be. The contaminated, fenced-off place with no access is now a welcoming, grand park for the community to take advantage of.

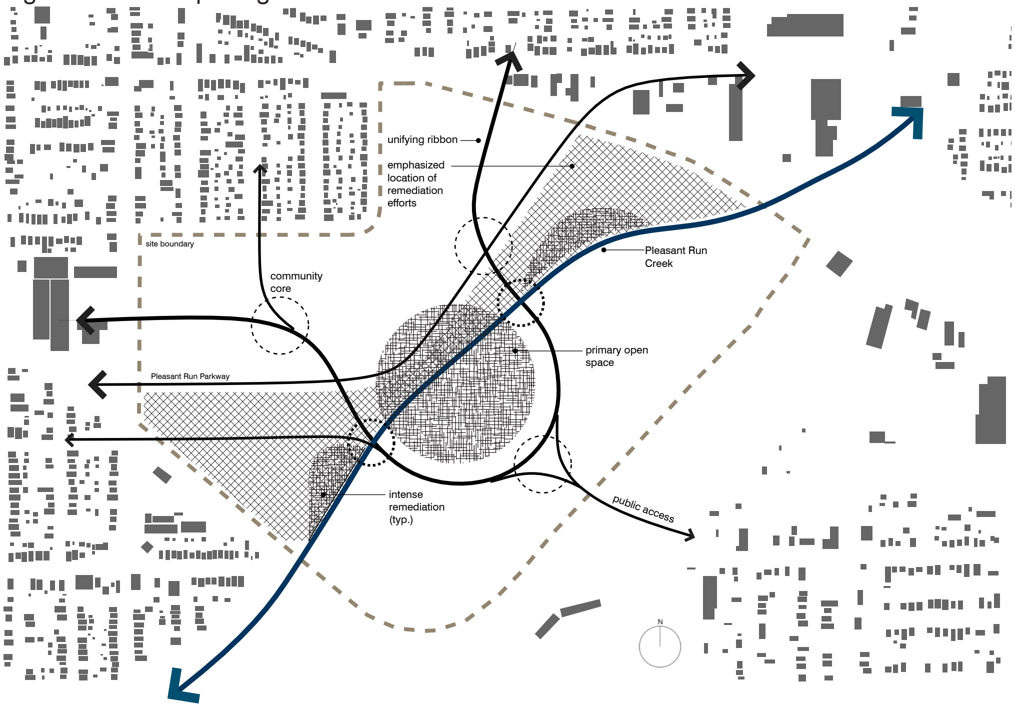
The unifying element between all site amenities is the sunken garden, shown meandering through the property to surround a variety of industrial structures and lawn space. This is the Great Lawn.

A community center and recreation complex is provided at the site of the old drive-in movie theater. This will serve as a place for gathering and education.

Existing administrative buildings are reused to serve as the spaces in which formal education can take place. Imagine school kids taking field trips to this site in order to learn more about industry and the environment.

Bioremediation methods are fully employed throughout the park to effectively remediate the property. These include phytoremediation, a constructed wetland, and strategic plantings.

Figure 15 - Concept diagram.



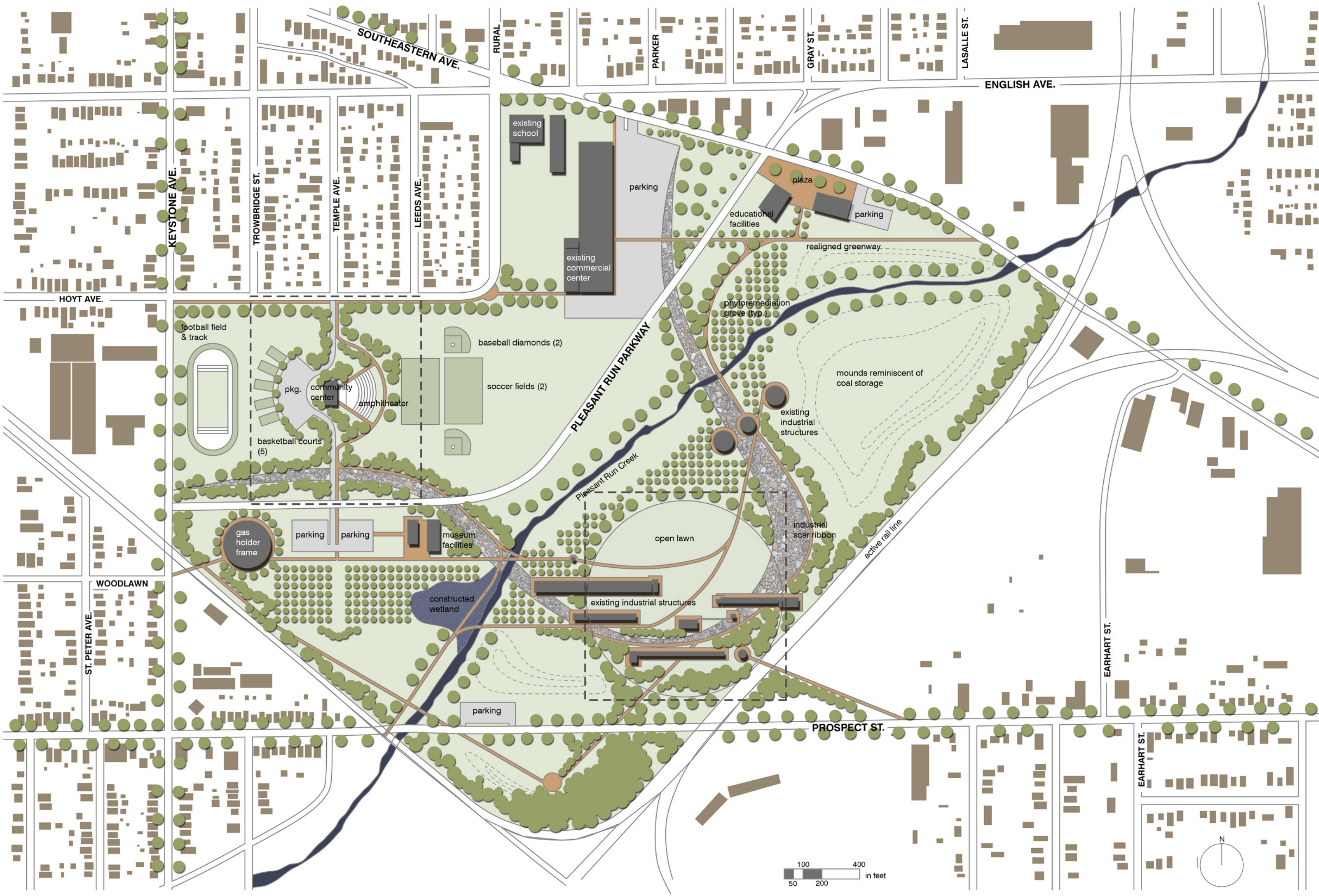
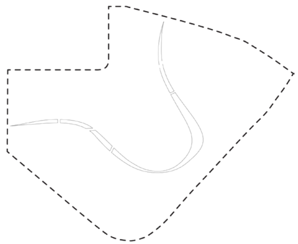


Figure 16 - Master plan.

Sunken Garden

The sunken garden is the primary unifying element throughout the park's design. Designed to be a metaphor for the plant's destruction of the local environment, it meanders throughout the site to connect various program areas and establish a system of pedestrian circulation. It is heavily planted with low-maintenance perennial grasses and wildflowers, all of which are hyperaccumulators. (See planting plans for more information on this topic.)



Below: Figure 17 - Sunken garden construction detail.
Opposite: Figure 18 - View across a bridge spanning the sunken garden with existing, iconic water storage tanks in the distance.

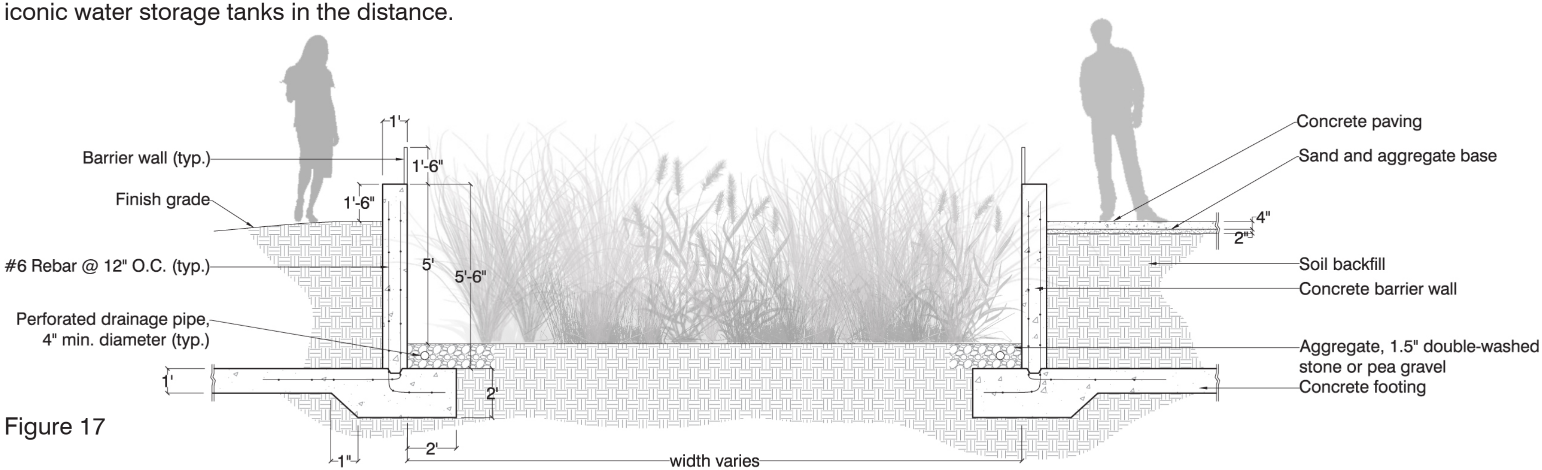


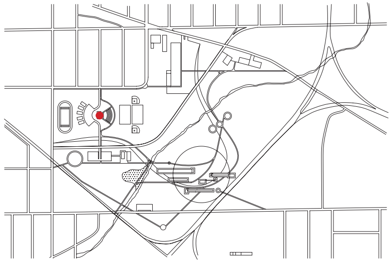
Figure 17


INDUSTRIAL SCAR
This sunken garden represents the scar that the MGP operations have left on the landscape in the park. Strategic plantings of grasses and perennials clean the soil and water for visitors like you to enjoy.
Please beware of edge.
C10

Figure 18

Community center & recreation complex

Based on the geometric vehicular circulation of the drive-in theater that once existed on this part of the site, the new community center and recreation complex provide important amenities to the local community. Active recreation is the focus here, as well as community gathering. A sunken amphitheater connects directly to the community center to provide gathering space for performances, lectures, classes, kids camps, etc. Interestingly, the community center rests at the past location of the projector house for the drive-in theater.



Below: Figure 19 - Section drawing of the area including the community center, amphitheater, boulevarded entry road, and entry plaza.
Opposite: Figure 20- Detail plan.

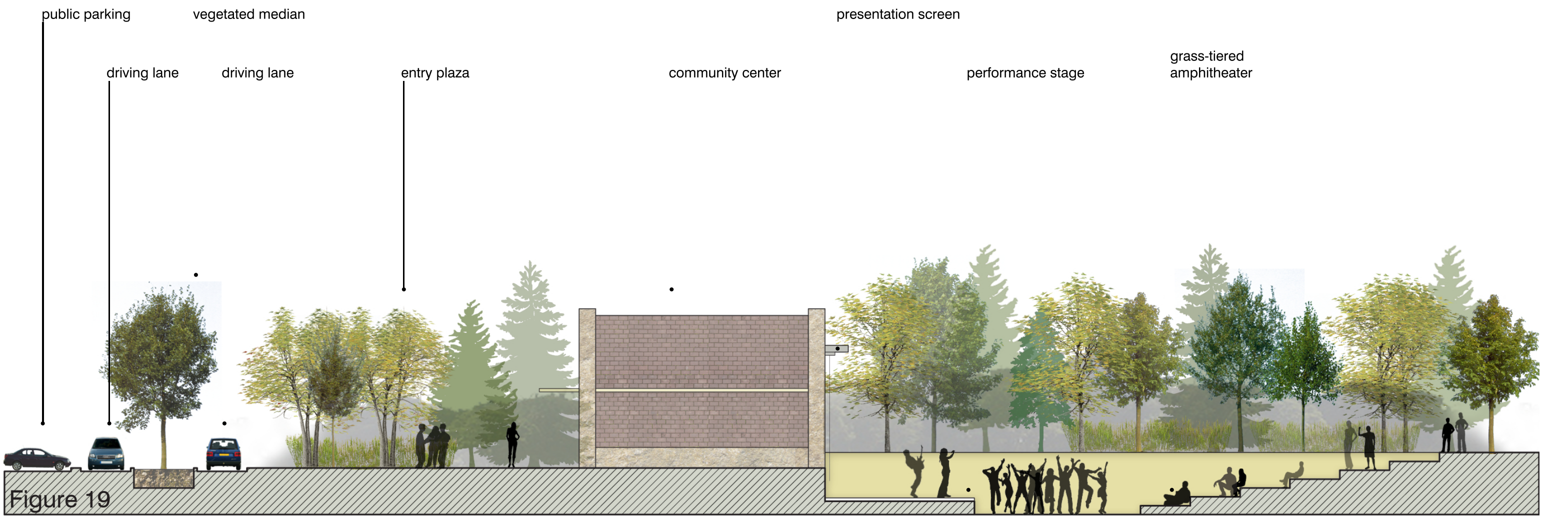
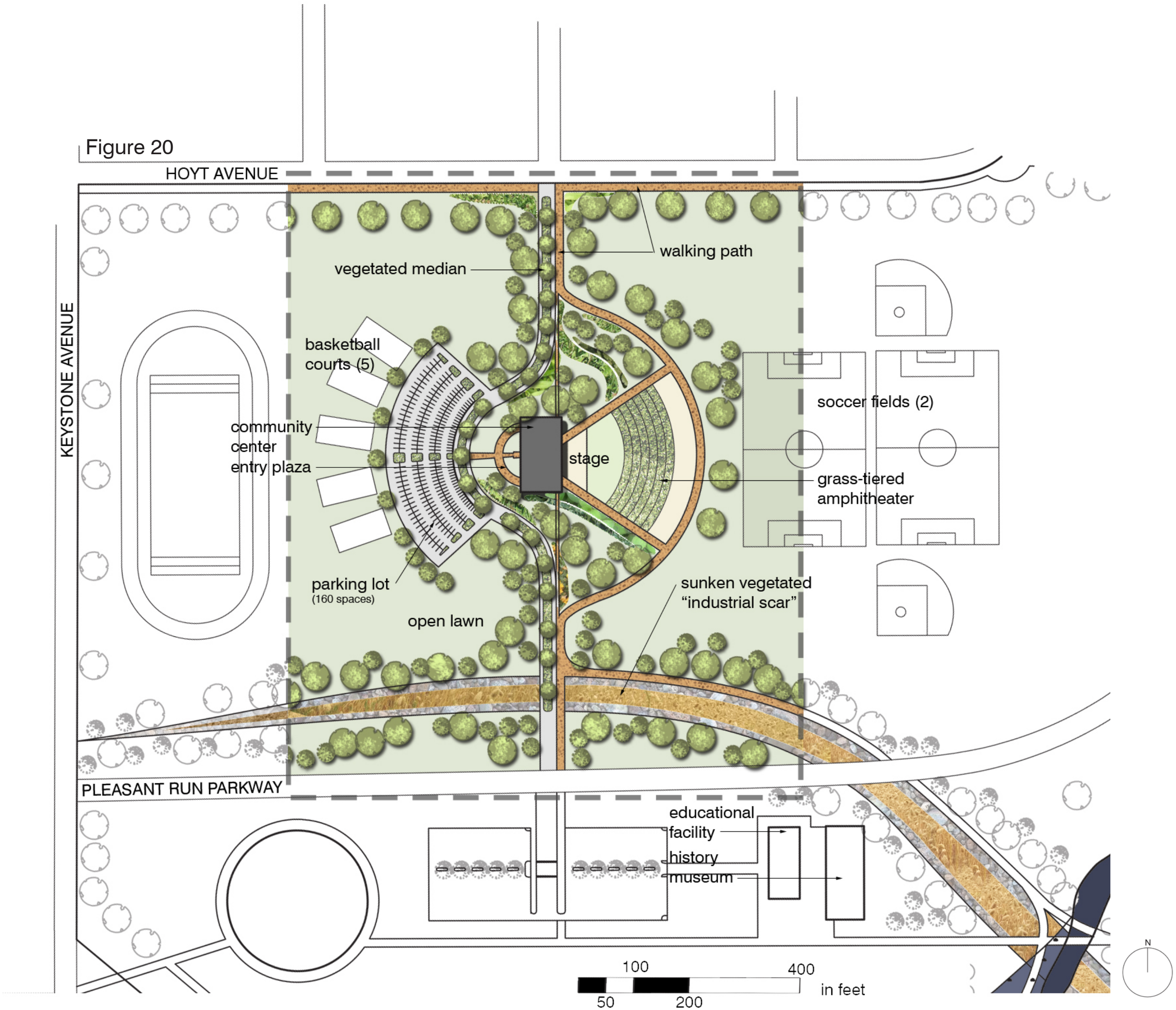


Figure 19

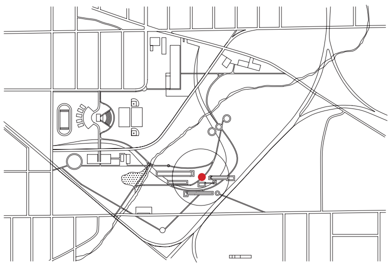
Figure 20


HOYT AVENUE
KEYSTONE AVENUE
walking path
vegetated median
basketball courts (5)
community center
entry plaza
stage
soccer fields (2)
grass-tiered amphitheater
parking lot
(160 spaces)
open lawn
sunken vegetated "industrial scar"
PLEASANT RUN PARKWAY
educational facility
history museum
100
400
50
200
in feet
N

Site plan

Great Lawn

The Great Lawn immediately surrounds a collection of industrial structures to remain on the site. It is a place for passive recreation, where vistors can enjoy navigating the park's curvilinear paths and also enjoy meeting with friends. It is an open space focused primarily on highlighting the towering industrial monuments and surrounding birch and poplar groves.



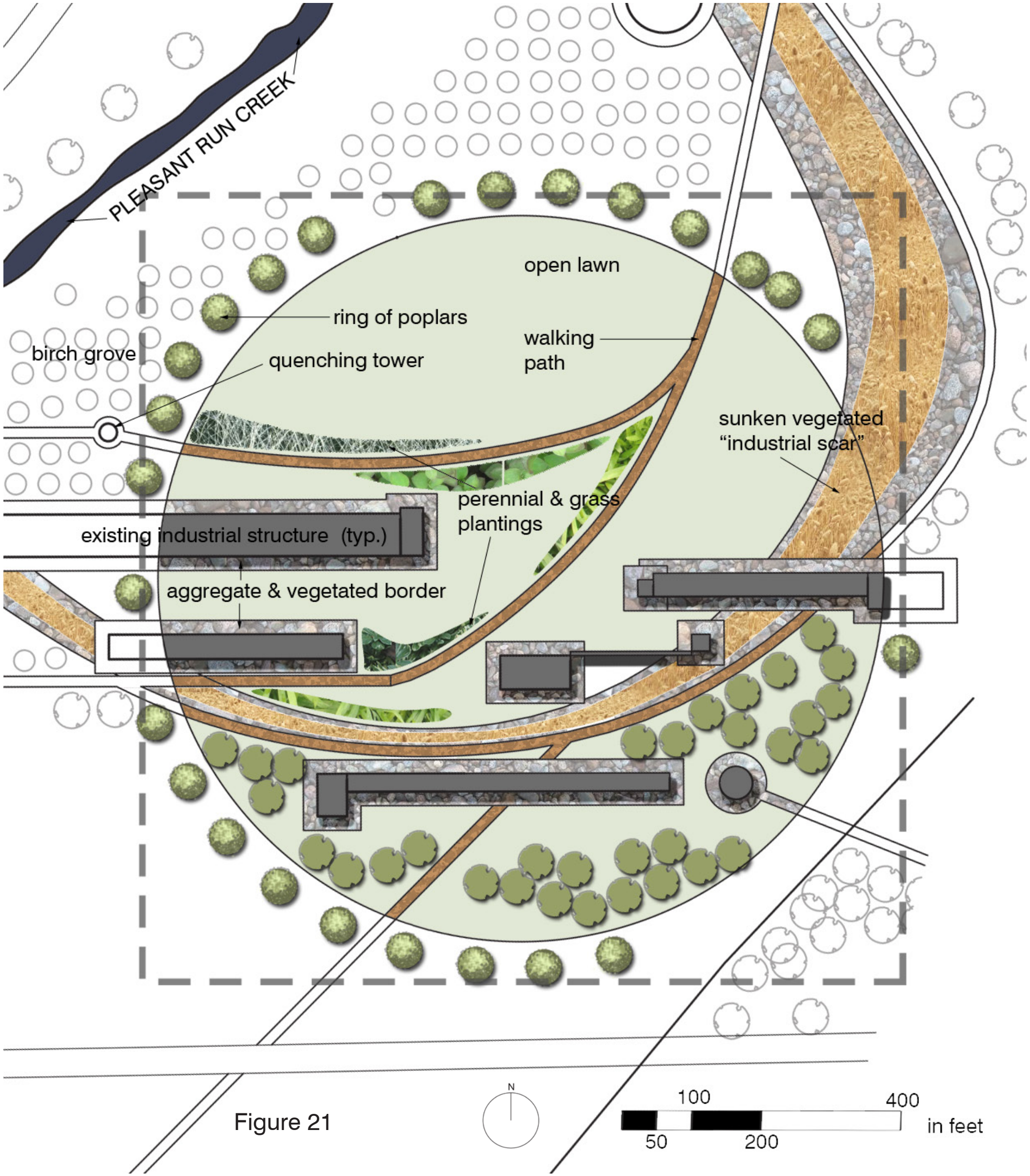


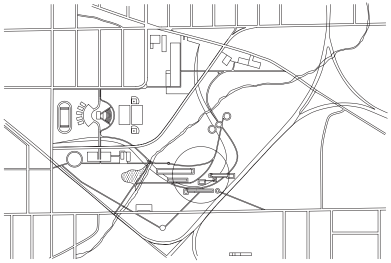
Figure 21

Right: Figure 21 - Detail plan
Opposite: Figure 22 - A pedestrian's view of the Great Lawn

Figure 22

Southwest wetlands

The wetlands are a major amenity to the site as they ensure that the remediation process is visible to the naked eye. Visitors will be able to easily see the process of filtration occur and to learn about how this works, with the help of tour guides, educators, and helpful signage. Its location just south of the educational facilities only strengthens this educational goal since more in-depth information can be found within close proximity to the wetlands. The boardwalk over the wetlands allows visitors to interact even more efficiently with the remediation system.



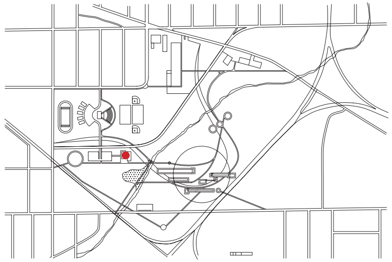
Opposite: Figure 23- A visitor's view of the boardwalk that spans over the constructed wetland

Figure 23

Program Area

Environmental education facilities

Here the plant's existing adminsitrative facilities are converted into the core zone for formal education. The iconic brick buildings remain where they stand in two prominent locations along Pleasant Run Parkway. They are easily accessed by the community and provide areas in which gatherings can happen within the community. Schools kids are the emphasis here. However, anyone within the community is welcome to visit the museum that emphasizes both industrial and environmental education.



Below: Figure 24 - Section of the educational zone, showing the relationship to the dominant gas holder frame
Opposite: Figure 25 - The plaza surrounding the educational facilities, a meeting point for school & community groups

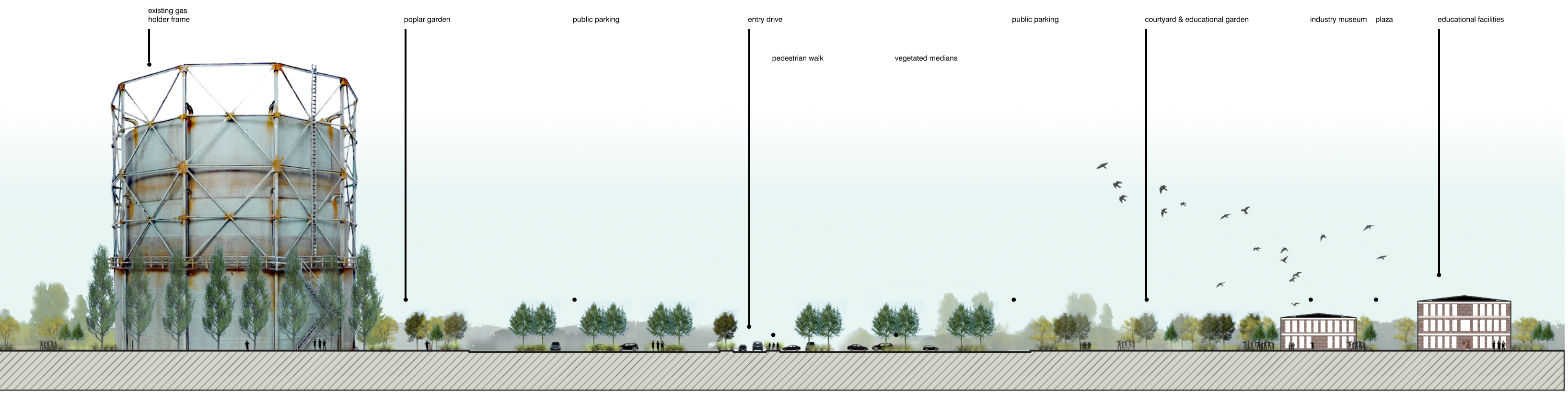


Figure 24

Figure 25

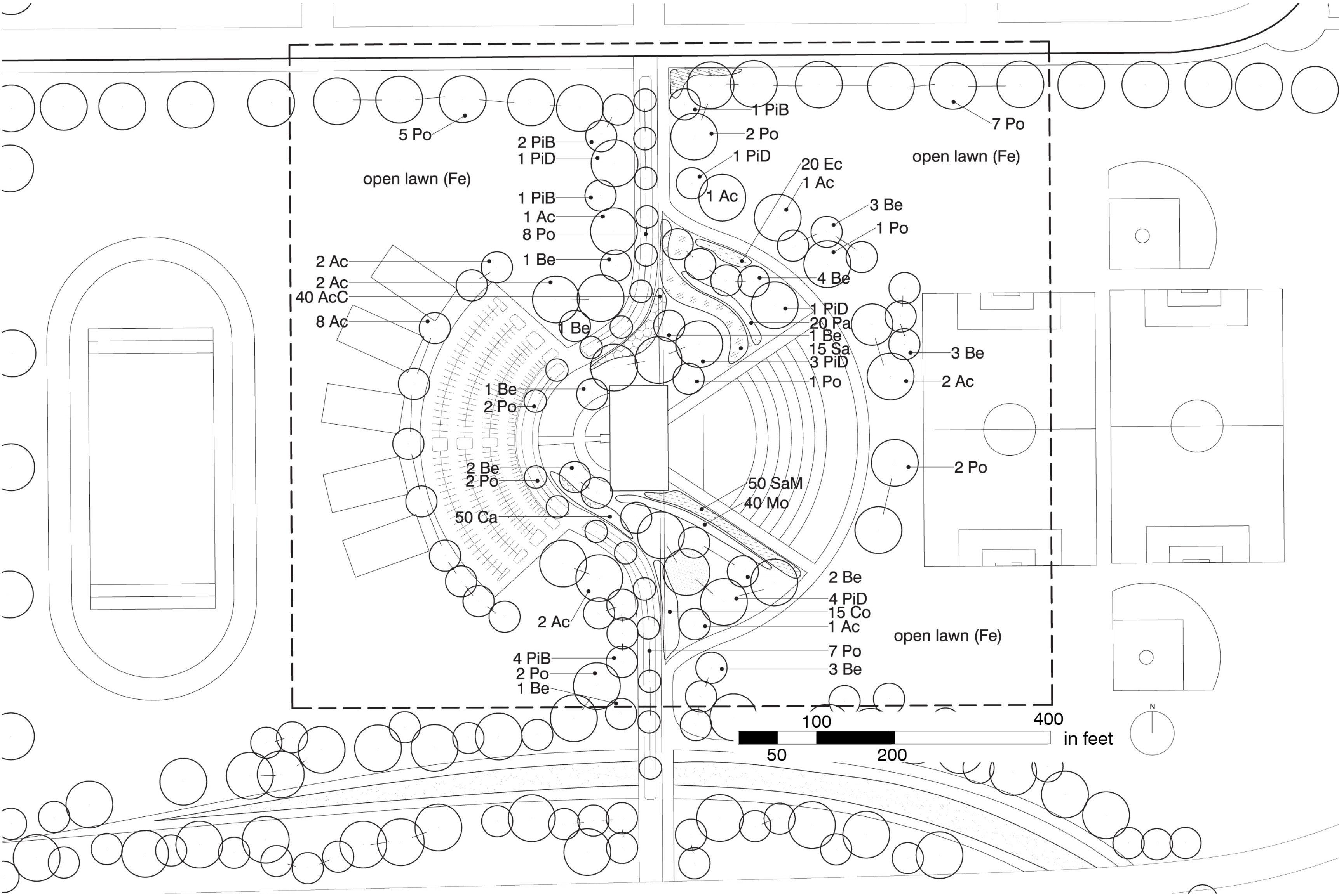
Planting plan: community center

Since there was a high emphasis on natural systems throughout the project, the appropriate use of plant material was of high importance. Surrounding the community center are plant species that are appropriate for this part of the country and that are particularly effective at remediating contaminated sites. The vegetation here is used to soften the area surrounding the community center and to provide an oasis and shaded area for visitors using the recreational facilities.

Figure 26

No.	Symbol	Scientific name	Common name	Container/Conditions
Trees				
20	Ac	Acer rubrum	red maple	3" cal. B & B
22	Be	Betula populifolia	gray birch	2" cal. B & B
8	PiB	Pinus bungeana	lacebark pine	2" cal. B & B
10	PiD	Pinus densiflora	Japanese red pine	2" cal. B & B
38	Po	Populus alba	white poplar	2" cal. B & B
Shrubs				
15	Co	Cornus sericea	red twig dogwood	1 gallon
15	Sa	Salix purpurea ' Dicky Meadows'	blue arctic willow	2 gallon
Perennials and Grasses				
40	AcC	Acorus calamus	sweet flag	3.5" cont.
50	Ca	Carum carvi	caraway	4" cont.
20	Ec	Echinacea purpurea	purple coneflower	6" cont.
40	Mo	Monarda citriodora	lemon mint	3" cont.
20	Pa	Panicum virgatum	switchgrass	6" cont.
50	SaM	Satureja montana	winter savory	4" cont.

Below: Figure 26 - Plant list with specifications.
Opposite: Figure 27 - Planting plan for the community center.

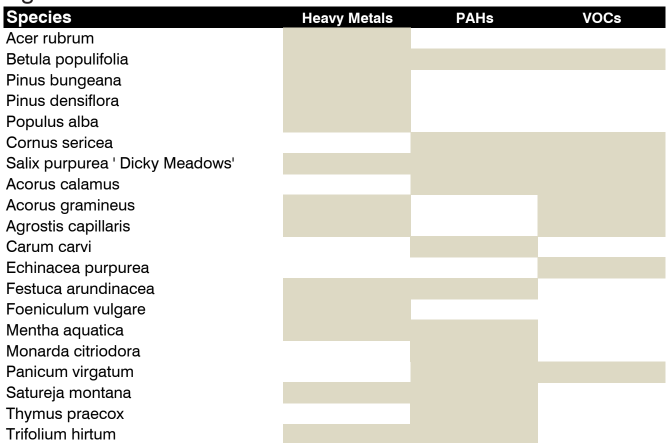

5 Po
2 PiB
1 PiD
open lawn (Fe)
1 PiB
1 Ac
8 Po
1 Be
2 Ac
2 Ac
40 AcC
8 Ac
1 Be
1 Be
2 Po
2 Be
2 Po
50 Ca
2 Ac
4 PiB
2 Po
1 Be
1 PiB
2 Po
1 PiD
1 Ac
20 Ec
1 Ac
3 Be
1 Po
4 Be
1 PiD
20 Pa
1 Be
15 Sa
3 PiD
1 Po
7 Po
open lawn (Fe)
3 Be
2 Ac
2 Po
50 SaM
40 Mo
2 Be
4 PiD
15 Co
1 Ac
7 Po
3 Be
open lawn (Fe)
100
400
50
200
in feet
N

Planting plan: Sunken garden

The selection of plant material was done very carefully in order to create a plant palette that was scientifically provide to absorb contaminants throughout the site. The chart below (Figure 28) explores each plant species and the nasty chemicals they naturally absorb. These species are known as “hyperaccumulators”. See Figure 29 for a visual depiction of the variety of textures, colors, and forms displayed by this vegetation.

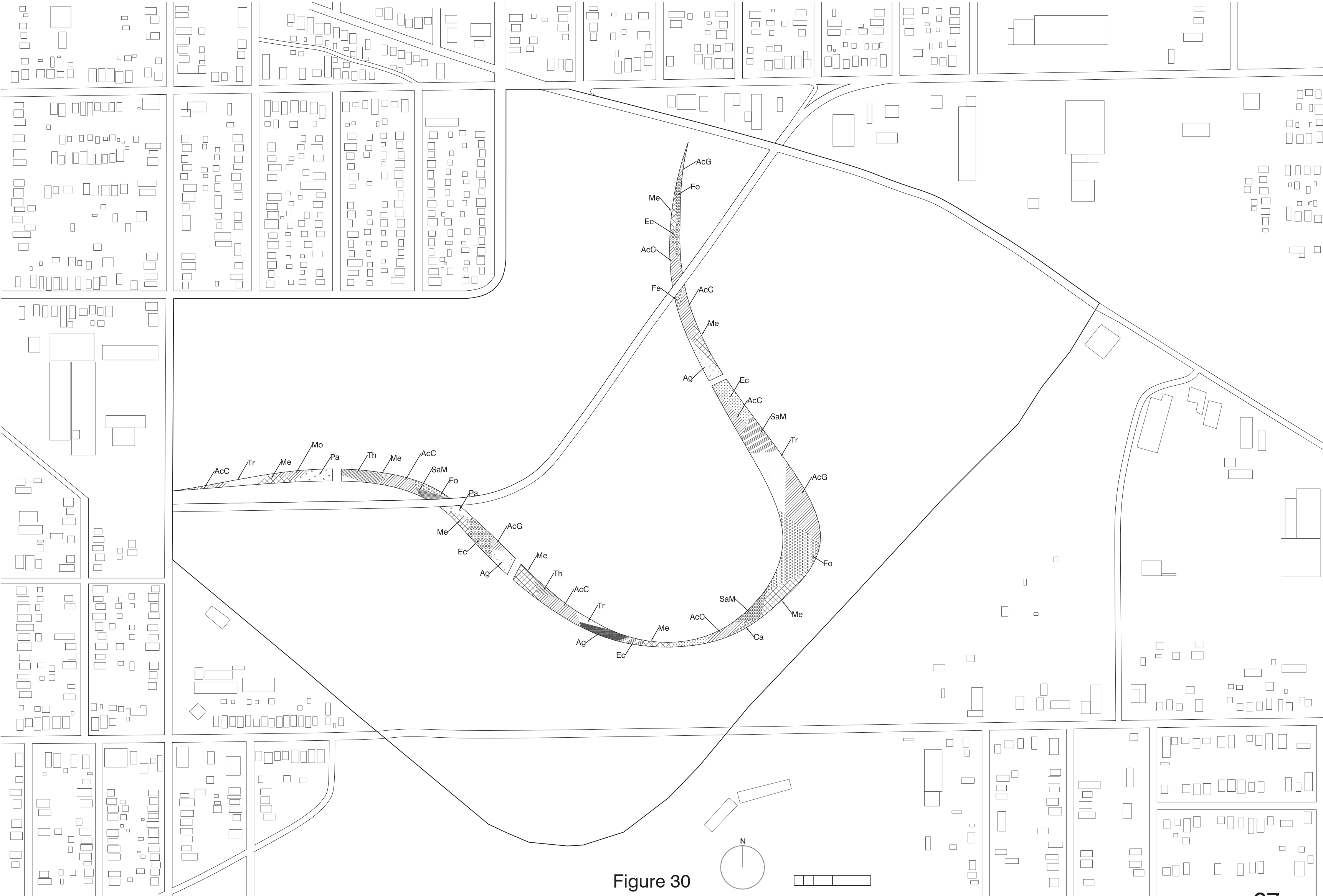
Bottom, left: Figure 28 - Hyperaccumulator chart.
Bottom, right: Figure 29 - Plant palette
Opposite: Figure 30 - Sunken garden planting plan

Figure 28



Notes:
Heavy metals include: Arsenic, lead, mercury, cadmium, chromium, uranium, zinc, etc.
PAHs include: Benzopyrene, Benzoanthracene, Idenopyrene, Anthracene, Chrysene, Phenanthrene, etc.
VOCs include: Methylnapthalene, Benzene, Napthalene, etc.

Figure 29



AcG
Fo
Me
Ec
AcC
Fe
AcC
Me
Ag
Ec
AcC
SaM
Tr
AcG
Fo
Me
Ca
SaM
AcC
Me
Ec
Ag
Tr
AcC
Th
Me
Ag
Ec
Me
AcG
Pa
Fo
SaM
AcC
Me
Th
Pa
Mo
Me
Tr
AcC
N

Figure 30

Alignment plan: Sunken garden

The proper alignment of the sunken garden is paramount to the overall design as it is the backbone on which the design rests. Therefore, an alignment plan was an appropriate construction document to complete, shown in Figure 31. It is organized on a simple grid system originating at coordinates (0,0) on the western site boundary.

Opposite: Figure 31 - Sunken garden alignment plan

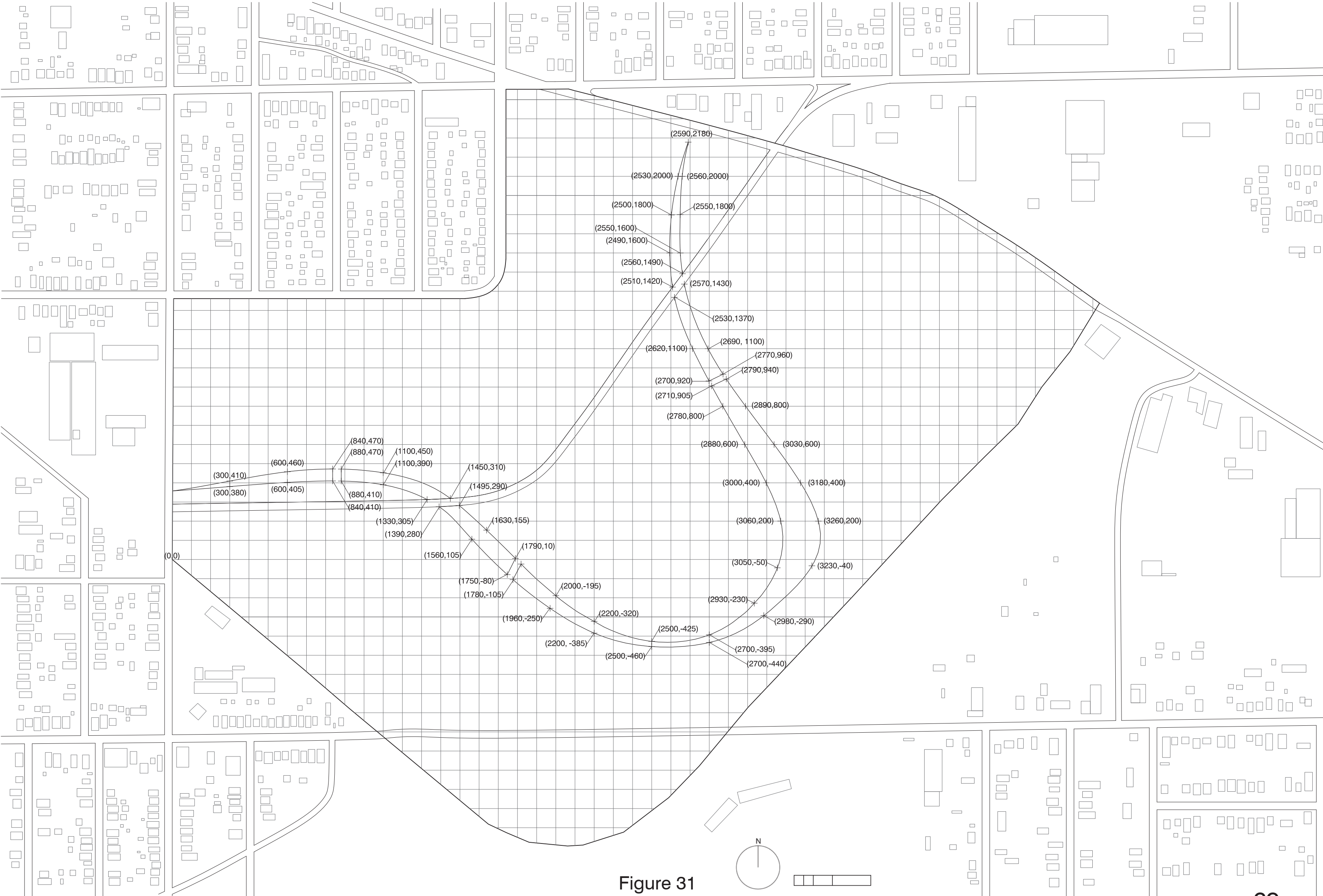
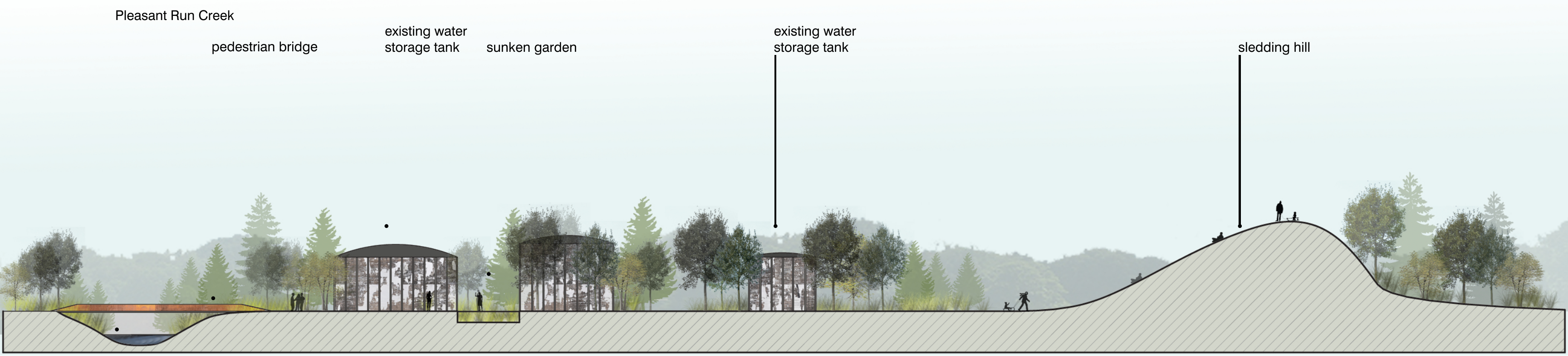

(2590,2180)
(2530,2000)
(2560,2000)
(2500,1800)
(2550,1800)
(2550,1600)
(2490,1600)
(2560,1490)
(2510,1420)
(2570,1430)
(2530,1370)
(2620,1100)
(2690, 1100)
(2770,960)
(2790,940)
(2700,920)
(2710,905)
(2780,800)
(2890,800)
(2880,600)
(3030,600)
(840,470)
(880,470)
(1100,450)
(1100,390)
(600,460)
(1450,310)
(300,410)
(1495,290)
(300,380)
(600,405)
(880,410)
(840,410)
(3000,400)
(3180,400)
(1330,305)
(1390,280)
(1630,155)
(3060,200)
(3260,200)
(1560,105)
(1790,10)
(0,0)
(3050,-50)
(3230,-40)
(1750,-80)
(1780,-105)
(2000,-195)
(2930,-230)
(1960,-250)
(2200,-320)
(2980,-290)
(2200, -385)
(2500,-425)
(2500,-460)
(2700,-395)
(2700,-440)
N

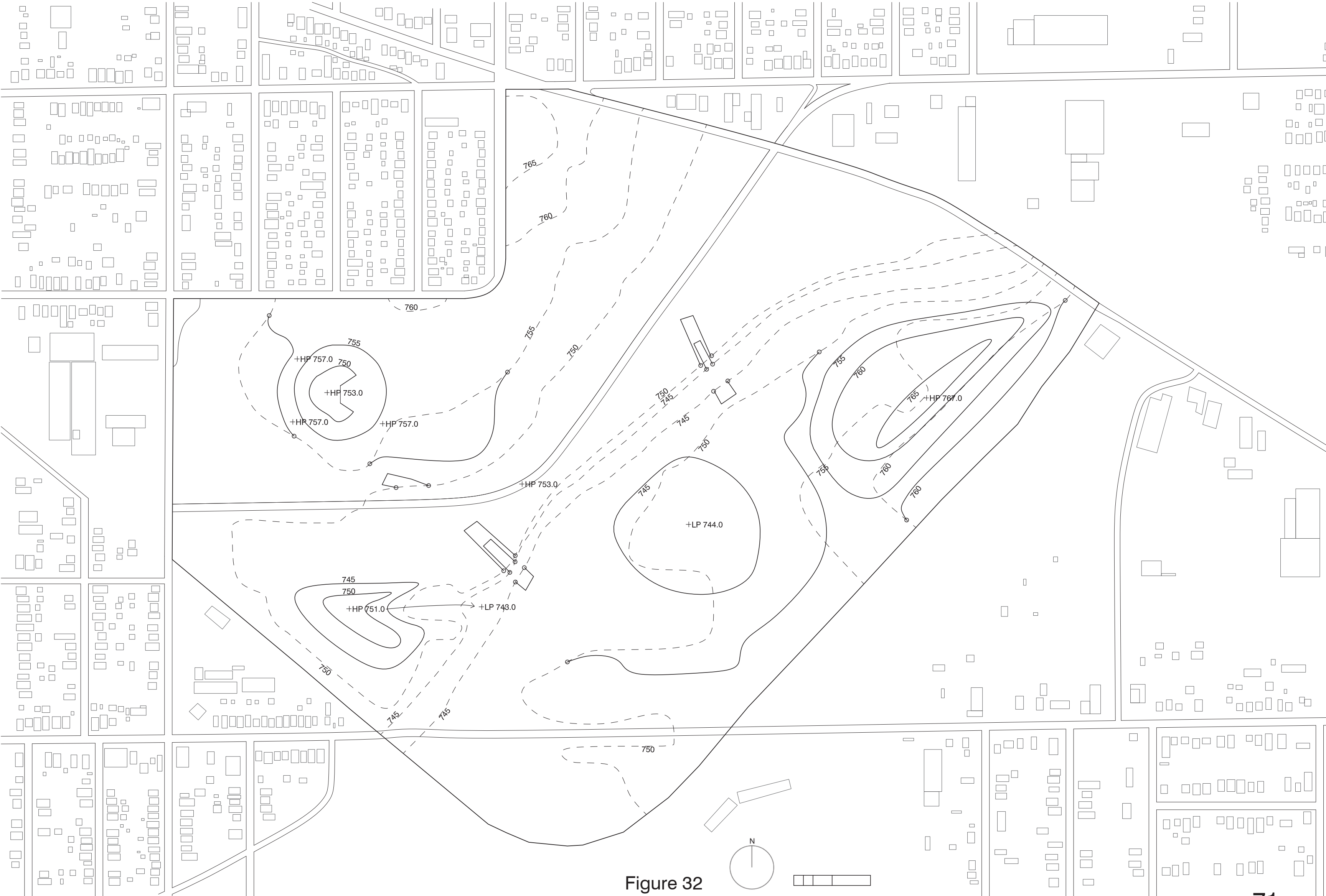
Figure 31

Grading plan

Overall, site grading and earth moving was kept to a minimum. This decision was made in order to minimize the amount of soil disruption which causes an increase in air pollution on and surrounding the site, which would affect the local community. Despite little earth moving, a large mound to the east is created to reflect that area's former use as the place for coal storage. This mound becomes a prominent sledding hill for kids in the surrounding neighborhoods (see Figure 32).This soil fill is then balanced by the soil cut created by the constructed wetland. Also take note that minimal site grading was necessary surrounding the community center to ensure topography appropriate for active recreational sports.



Opposite: Figure 32 - Site grading plan



765
760
760
755
750
755
750
HP 757.0
HP 753.0
HP 757.0
HP 757.0
HP 753.0
750
745
745
750
745
LP 744.0
755
760
765
HP 767.0
755
760
760
745
750
HP 751.0
LP 743.0
750
745
745
750
N

Figure 32

Bioremediation strategy plan

Locating where each bioremediation method would occur was important to ensure that remediation goals were met. It is clear from looking at the bioremediation plan (Figure 33) that most bioremediation occurs on the southeast half of the site as that is where most of the industrial structures existed and where most destructive activity occurred. Phytoremediation is the most widely used method in the form of poplar and birch groves. Biostimulation is also widely used. This method would most likely be the first strategy employed on the site since it is the most elaborate process that takes a good deal of effort. And lastly, a constructed wetland is provided at a naturally-sloping area to ensure that water filtration is effective.

Opposite: Figure 33 - Bioremediation plan

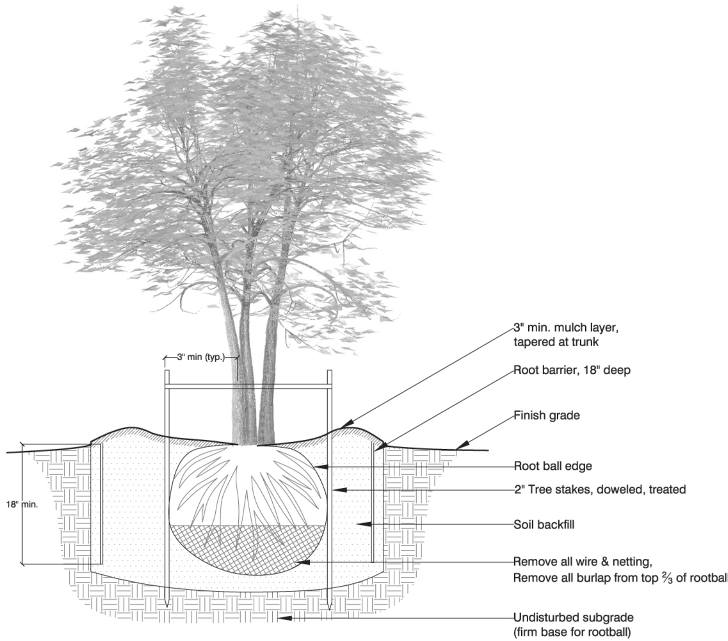

KEY
phytoremediation
biostimulation / land farming
constructed wetland
constructed wetland &
biostimulation / land farming
constructed wetland &
phytoremediation
N

Figure 33

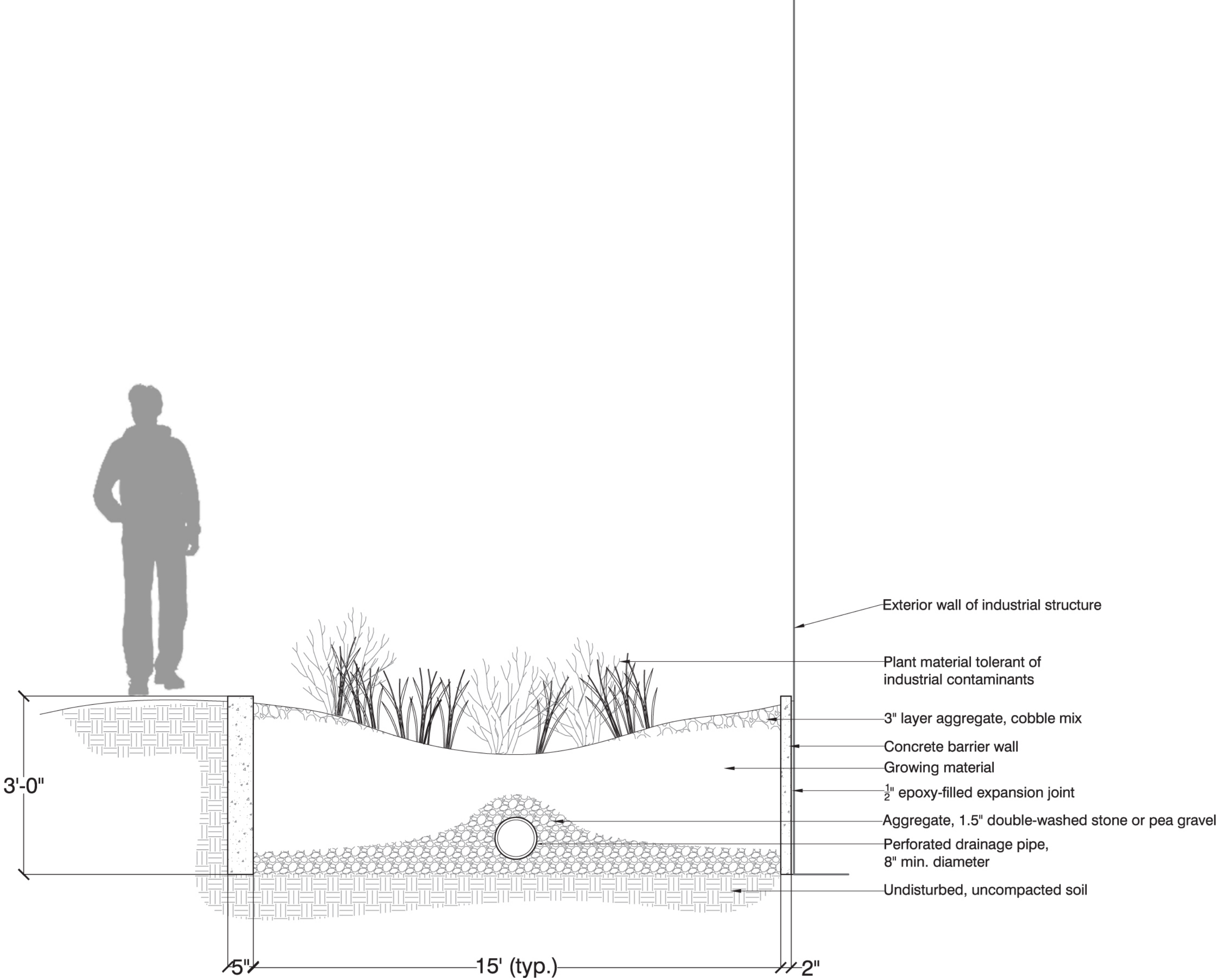
Construction Details

Figure 34 explains how the planting should be completed on the site. This is important due to the sheer amount of planting needed. Figure 35 explains how the area immediately surrounding existing industrial structures may be treated. It is important to provide for park users' safety. Because of this, a planted border lined with heavy cobbles or aggregate may be the best and most aesthetically-pleasing alternative to a fence.

Right: Figure 34 - Planting detail.
Opposite: Figure 35 - Construction detail for area surrounding industrial structures.



Planting Detail
Figure 34



Treatment adjacent to industrial structures
Figure 35

Wayfinding

The image below shows how concrete and rusted steel can be reused on-site to create interesting wayfinding and informational signage. They are simple constructions but would emphasized the industrial heritage of the place and be easy to care for.

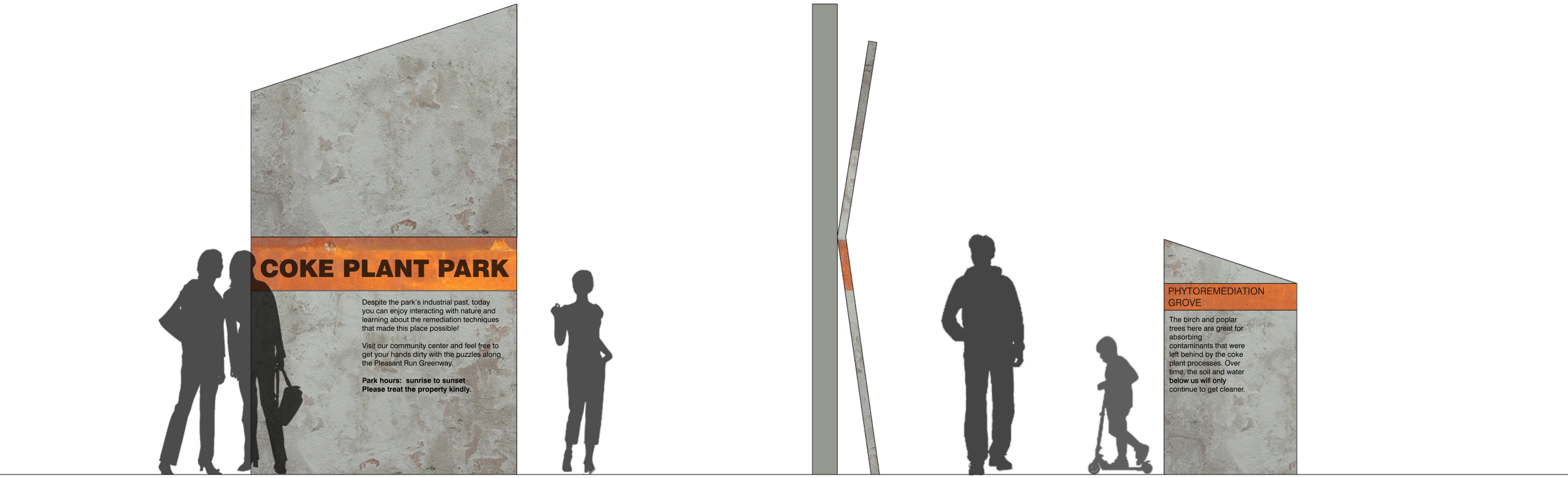


Figure 36

Site programming

The chart below shows how both existing and new activities are great opportunities for the community and establish a vibrant community in this area year-round.

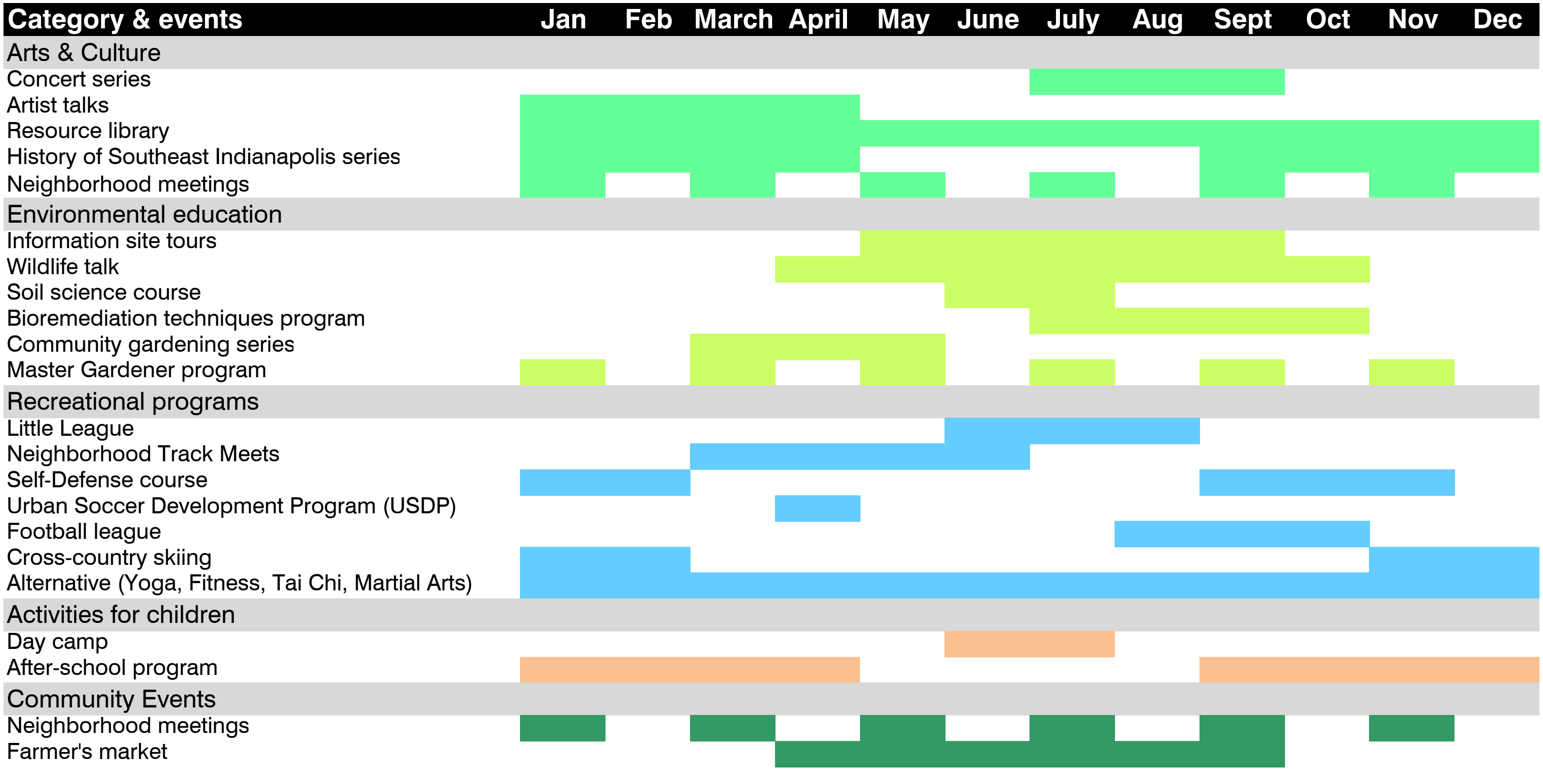


Figure 37

Conclusion

Overall, this park was designed to be an example of how post-industrial sites can be reused effectively within the urban fabric. Modern urban environments are ripe with these void, underused spaces. However, they provide great opportunities for reenvisioning our future relationship with nature and reestablishing public space within cities. After exploring this topic for over a year, it is blatantly clear to me that vacant and inactive spaces just like the Citizens Energy Manufactured Gas Plant can indeed become our public parks- places for recreation, education, and legitimate environmental revitalization. It is here that local residents are given the opportunity to learn about the natural environment and how it can be restored and are also able to enjoy the benefits of recreation to improve their social, physical, and mental health. Overall, major economic, social, and environmental benefits are reaped from this kind of redevelopment. It is time for communities to redefine how they treat derelict sites and re-envision their value as community open spaces.

Throughout the project, I explored complex systems and hard science and learned quite a great deal about the sheer power of plants to transform “ugly” places into beautiful versions of nature. I enjoyed dreaming and conjuring up a new identity for this place. I can only hope that something can be done in the future to make this project or its concept a reality.

Definitions

Bioremediation: the process of restoring a piece of land to its original state of health through the use of environmentally-sensitive methods

Biostimulation: the addition of proactive bacteria and nutrients to contaminated soil in order to encourage or restore soil health and quality

Brownfield: a property whose redevelopment is complicated by the presence of hazardous materials

Coke plant: a manufacturing complex where the production of industrial coke, a metallurgical product, takes place

Constructed wetland: an artificial system often comprised of a series of basins that contain water-loving plants, algae, and bacteria that are naturally capable of extracting contaminants from waste water

Landfarming: the process in which contaminated substances are removed from the disturbed site, transported elsewhere, spread over a large area, and treated to allow substantial degradation of harmful substances

Phytoremediation: the bioremediation method that relies on the natural ability of plants to absorb contaminants from water and soil

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